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OF THE OFFICE FOR PATENTS, CHANCERY LANE.

(Assisted by several Scientific Gentlemen.)

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RECENT PATENTS.

To Christian Schiele, *of Manchester, in the county of Lancaster, mechanician, for his invention of certain improvements in the construction of cocks or valves; which improvements are also applicable for reducing the friction of axles, journals, bearings, or other rubbing surfaces in machinery in general.*—[Sealed 23rd November, 1848.]

These improvements apply principally to cocks or valves, and to axles, journals, bearings, or other rubbing surfaces in machinery which have to bear a pressure in the direction of their axes. The invention consists in the application of a curved form (instead of a rectilinear form, usually employed,) to the construction of cocks and valves, and also to the construction of axles, journals, bearings, or other rubbing surfaces in machinery in general, in order to reduce their friction and consequent wear and tear. The nature of the curve which the patentee prefers, as generally the most suitable for the construction of the said curved form, consists in having every tangent of the same length from the touching point to the point of intersection with the axis of the curve, as will be hereafter more fully explained.

In Plate I., fig. 1, represents a plan and end view of a small apparatus for describing such a curve. *a, a,* is a small wooden slide, to which the rod *b, b,* is jointed by means of a pin *c*; *d,* is a slide or bush, to which a drawing-pen is affixed; and *e, e,* is a ruler, along the edge of which the slide *a,* is to be guided. If the slide *a,* and rod *b, b,* be so placed that the pin *c*, shall be at *f*, and the pen *d*, at the point *g*, the centre line at the rod *b*, *b*, will then be over the dotted line *g*, *f*, at a right angle with the dotted line *l*, *n*; and if the slide *a*, be then guided along the edge of the ruler *e*, *e*, the pin *c*, will move along the dotted line *l*, *n*, dragging the pen *d*, after it; which, in travelling over a horizontal plane, will describe the curved line *h*, *m*. The pen *d*, can be moved upon the rod *b*, to the proper distance for the curve required, and is kept in that and in a vertical position by a spring, which fits in a groove. *l*, *n*, is the axis of the curve; and *g*, *f*, *h*, *l*, *m*, *n*, represent some of the tangents above mentioned.

Fig. 2, represents a vertical section of the shell of a stop-cock, shewing the application of the invention to the seats or surfaces of contact of the same. The dotted lines, near the top of the plug *a*, represent a groove in the plug for the reception of a key. Fig. 3, represents the application of the invention to the seats or surfaces of contact of lift-valves for pumps. Fig. 4, shews the application of the invention to the journal and bearing of a regulator for a locomotive engine, to be used instead of a stuffing-box. *a*, is part of the boiler of a locomotive engine; *b*, is the spindle of the regulator; *c*, is the journal; *d*, is the bearing; and *e*, is the lever or handle by which the regulator is turned. The spindle *b*, is furnished on that end which is inside the boiler with a square hole, for the reception of the squared end of a rod *g*, which has to transmit the motion to the valve. Fig. 5, shews the application of the invention to the journals and centres of turning lathes. Figs. 6, and 7, shew the application of the invention to axles on the parts *a*, *b*, *c*. Here the pressure acts only at intervals in the direction of the axis, and must therefore be borne separately. The difference of their construction from that commonly in use will be seen on comparing figs. 6, and 7, with figs. 8, and 9. Figs. 10, and 11, shew the application of the invention to pivots or axes for astronomical, or surveying, or other such instruments.—For comparison, see fig. 12, which shews a mode of construction now commonly in use. The curved form, as shewn in fig. 11, is also applicable to foot-steps of upright shafts, &c. Fig. 13, shews the application of the invention to the construction of the threads of screws. When the pressure against the surfaces to be constructed, in the mode described, acts in the direction of the axes of such surfaces, then the curve is commenced at that part which is shewn in fig. 1, at *g*.—For examples see fig. 2, at *b*, *c*, and *d*; figs. 3, and 4, at *c*, *d*, and *i*; figs. 6, and 7, at *a*, *b*, *c*; fig. 11; and fig. 13. When part of the pressure acts from the side, the patentee commences with such a part of the curve which, in its inclination to the axis, would give the best resistance to the middle pressure of the combined forces.—For example see fig. 2, at *a*; fig. 4, at *h*, *h*; fig. 5, at *a*, and *b*; and fig. 10.

The patentee remarks that his improvements include the application of all curved forms, diverging from forms hitherto in use towards the described curved form, for the purposes set forth. He claims as his invention, First,—the improvements in the construction of the seats or surfaces of contact of cocks or valves, which have to fit against each other for shutting off the passage of fluids, &c., as shewn in the drawing, and as above described. And, Secondly,—the application of such improvements to the construction of axles, journals, bearings, or other rubbing surfaces in machinery in general, for reducing the friction resulting from pressure acting in the direction of their axes.—[*Inrolled May,* 1849.]

To ALFRED VINCENT NEWTON, *of the Office for Patents,* 66, *Chancery-lane, in the county of Middlesex, mechanical draughtsman, for an invention of certain improvements in the manufacture of steel,—being a communication.*— [Sealed 2nd November, 1848.]

THE apparatus employed in carrying out this invention is shewn in Plate II.; fig. 1, being a side elevation and partial section, and fig. 2, a plan view of the same, also partly in section. In these figures, A, is the furnace, and *a*, the front opening of the same; B, is the stack or chimney, and *b*, a flue in the chimney; *c*, is a valve or damper for regulating the draught of the flue; and *d*, is an iron door for closing the front of the furnace, which door is suspended by a balance-weight and chain, passing over a pulley *e*;—*f*, *f*, are notches in the front plate of the furnace, to support the bars when working the metal; *g*, *g*, *g*, are holes in the front plate, for tapping out the cinder; and *h*, is a tuyere-pipe, which enters the furnace A, and, to preserve it from sustaining injury from the fire, it is surrounded by water, conveyed through pipes *i*. C, C, are receptacles or reservoirs, made of iron, and lined with fire-brick: they are each provided with a cover at top, in which is a moveable door. *j*, *j*, are fire-bars, forming the bottom of the reservoirs, below which ash-pits *k*, *k*, are made. D, is a blast-pipe, having three branches, 1, 2, 3, two of which (1, and 3,) enter respectively the ash-pits of the receptacles C, C. E, is a similar blast-pipe, two branches of which (1, and 3,) proceed from near the top of the receptacles C, C, and, joining at E, form, with the tuyere-pipe *h*, a passage into the furnace A;—*m*, are valves in the blast-pipes. The interior of the furnace A, is lined with side-plates *a**, *a**, made of cast-iron, or fire-proof plumbago and clay tiles. *d**, is a cast-iron hearth, in front of the furnace door. The furnace is enclosed by plates of iron *e**; and the stack or chimney B, is made secure by iron bolts *f**, *f**. The central branch 2, of the blast-pipe D, is continued under or between the receptacles C, and enters the pipe E,—see fig. 2.

The process of making steel is as follows:—The iron, after having been prepared, as will hereafter be described, is placed in the bed of the furnace A, fig. 2, and covered with charcoal. The receptacles or reservoirs C, C, are then filled with charcoal (or, in some instances, when the iron is easily converted, a mixture of charcoal and peat-coal), and, when ignited, the lids are put on and luted down, so as to prevent an escape of gas. An air-blast, which must be regulated at the will of the operator, is then to be applied to the aperture D, figs. 1, and 2. This blast, by passing through the receptacles, creates a gaseous oxide of carbon, which is driven upon the iron in the furnace A, through the pipe E, and tuyere *h*. In addition to this current of gaseous carbon there must be another air-blast, passing into the furnace through the branch 2, of the pipe D, regulated by its damper *m*, so that atmospheric air may be admitted, if necessary, to aid in producing the combustion required to melt the metal. This last blast should be used very sparingly, and only in quantities sufficient to enable the operator to bring the metal to nature. When melted, the metal is to be worked somewhat after the ordinary process for refining iron. An important part of the process consists in so graduating, by means of the valves *m*, the proportions of gaseous carbon and of atmospheric air thrown into the furnace, as at the same time to bring the metal to nature and carbonize it, so as to convert it into steel. No definite rules can be given to determine, in all cases, the exact proportions of gaseous carbon and atmospheric air requisite to produce this conversion; for much depends upon the quality and quantity of iron to be converted, and upon the judgment and skill of the operator in conducting the process, which should be continued until the metal is properly brought to nature (that is, sufficiently refined to ball), when it should be taken out and carefully forged into blooms. Skill is required to enable the operator to treat the metal in the furnace, and to determine that precise degree of refinement and carbonization which is requisite to produce the best steel. This can be obtained by practical experience only. To reduce the blooms into bars, they should be heated in a close furnace, with charcoal, peat-coal, or a mixture of charcoal and peat-coal. During the working of the metal in the furnace A, it should be carefully covered with charcoal, and excluded as much as possible from external air, by means of the door *d*, fig. 1.

Previous to submitting the iron to the process above described, it is necessary (if pig-iron is used) to melt it over once, by the aid of the hot carbonic-oxide blast; or (when wrought-iron is used) to melt it over once in plumbago crucibles,—the metal being first stratified with powdered charcoal or other combustible material abounding in carbon.

The first of these preparatory methods may be accomplished by attaching to a common cupola furnace (which is to be charged, in all respects, after the ordinary method of melting pig-iron) two receptacles or reservoirs, similar to those in the accompanying drawing, of sufficient size to hold a quantity of charcoal, which shall not be all consumed until the iron is melted. The receptacles (which are to be attached to the cupola furnace in the same manner as they are joined to the furnace in the drawing) are to be charged with charcoal, which is to be thoroughly ignited by the time the fuel in the cupola furnace is ready for the blast. Now, instead of applying the air-blasts directly to the cupola furnace, they are to be applied to the receptacles as represented in the drawing; and the iron is melted by the aid of the hot carbonic-oxide blast, somewhat after the manner first described.

The second preparatory method may be accomplished by making use of the best kind of plumbago crucibles. (The inventor employs those made by Joseph Dixon, of New Jersey, United States of America). The wrought-iron should be stratified with carbonaceous materials, and then melted in these crucibles with anthracite or other coal, urged by an air-blast. By either of these two last-described processes the metal acquires steely properties, and becomes so modified in its character as to facilitate, very materially, its further refinement and improvement by the process first described.

The patentee claims the arrangement or combination of the several parts, as above described, of the apparatus, by which the operator is enabled, at the same time, to refine the metal in the furnace, and to force upon it currents of gaseous carbon and atmospheric air, in the manner and in such proportions as above explained, so as to convert it into steel.

Also the process of making steel by forcing upon metal, placed in a furnace, as herein described, by means of the improved or any other suitable apparatus, currents of gaseous carbon and atmospheric air, in such proportions as will keep up the requisite combustion in the receptacles and the furnace, to enable the operator to bring the metal to nature; while, at the same time, gaseous carbon is constantly forced upon it in such quantities, and in such a manner, as to effect and keep up that peculiar combination of iron and carbon which forms steel. He also claims the previous preparation of the metal, by melting it with the hot carbonic-oxide blast, or in plumbago crucibles, as above described, so as to modify its character, and render it capable of being more easily converted into steel by the process first above described.—[*Inrolled May, 1849.*]

To ALFRED VINCENT NEWTON, *of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, mechanical draughtsman, for an invention of certain improvements in dressing or cleaning grain, and in separating extraneous matters therefrom,—being a communication.*—[Sealed 22nd August, 1848.]

THESE improvements in dressing or cleaning grain refer particularly to the dressing of wheat and rye, so as to prepare them for the operation of grinding. The nature and advantages of this invention will be clearly understood by the following remarks of the inventor, forming an introduction to the more detailed description of the means of carrying out the invention, hereafter to be given:—

On an examination of the wheat-berry, it will be found to possess two distinct coverings, which are separated by a soft glutinous substance or cuticle. Enclosed beneath these coverings is the mealy part or farina. The external covering or bran possesses no nutritious property, but exhibits, in a mild form, the bitter principle adequate for the purposes of fermentation. This covering runs in parallel lines along the length of the berry, serving as a conductor of moisture to excite the germ to life. The interior covering constitutes the "fat-forming principle," and encloses the farina in lines that cross at right angles, producing the cellular formation. This covering is both sweet and nutritious, and supplies to the farina beneath it, when pulverized or reduced to flour, its essential strength and flavor. Hitherto this valuable portion of the wheat-berry, in the ordinary mode of flouring, was nearly all lost for human consumption, by being separated, with the bran, from the flour; but, by the present discovery, that portion which is valueless as food, namely, the bran, is effectually got rid of, together with all the filth known to adhere to the outer covering; whilst the nutritious property of the berry, for the support of human life, is wholly retained in the flour in a clean, healthy, and manageable form. The process by which this result is accomplished depends for its action upon the following properties of the berry:—The bran or external covering has a strong affinity for moisture, whilst the internal part of the berry possesses the power of repelling moisture for a time. This admits of the external covering being softened, while the inner remains firm and hard. When the corn is brought to this state, mechanical force is applied thereto, so as to produce a violent attrition of grain against grain, as well as against the surfaces of the rubbers or mechanical agents employed; and then the softened covering yielding to the superior friction of the hard surfaces, a perfect separation of the bran from the berry is obtained, without injury to the form of the berry or to its flouring properties. The great desideratum in the manufacture of flour has always been—to make the greatest possible yield of pure meal to the barrel, and to avoid the cutting up or grinding of the bran with the farina, which, when done, would speck the flour, and thereby lessen its value. This deterioration of the value of the flour is wholly avoided by the present system; for the bran being separated from the kernel before grinding, the difficulty cannot occur. Superadded to this fact is that, in the thorough removal of the outer covering, all other impurities peculiar to the grain are necessarily removed with the bran, and a pure healthy state of the berry is obtained for flouring.

The order in which the several parts of the process are performed is as follows:—First, in a vapour-chest, of suitable size, a series of revolving hexagonal wire-gauze conductors are mounted; and through these the corn from the granary is passed. Vapour is let into the chest to the desired amount, which, coming in contact with the corn, is readily absorbed by it; or, instead thereof, a tight box is employed, and, by means of a conveyor, the corn is passed through a column of water; and when the wheat is sufficiently saturated (from 30 to 60 seconds is sufficient for this purpose), the wheat is passed to an attrition-box, where the moistening process is succeeded by attrition; and when the bran becomes sufficiently disengaged from the corn, it is driven off by a current of atmospheric air. The corn is then conveyed to a hot-air chamber, of a similar construction to the vapour-chest,—it being provided with revolving gauze conductors, through which the corn is made to pass to evaporate any superabundant moisture that the corn may have taken up; a current of hot air being introduced into the chamber for that purpose. The corn is then subjected to another attrition, in its dry state, in a similar attrition-box, to disengage the small filaments of bran that may still adhere; and, after passing through another fanning process, it is delivered into the hopper of the mill, in its purest and healthiest form, ready for pulverization.

The advantages to be derived from this system of preparing wheat for grinding are stated as follows:—viz., First, all impurities and brown specula, which detract from the quality of the flour, are removed; secondly, nearly all the meal, which ordinarily becomes incorporated with the several varieties of offal, is saved, and an increased yield of the best quality of flour is the consequence; thirdly, an increased speed in grinding, with the same amount of power, is obtained,—the prior removal of the bran rendering the stones less liable to choke and heat than at present; fourthly, a superior quality of flour for hot climates is produced,—the bran which, by the common mode of grinding, is necessarily, to some extent, incorporated with the meal, being mainly the cause of the flour souring in hot climates; fifthly, a considerable saving of time is effected in dressing the meal produced from the prepared wheat.

In Plate I., the apparatus for carrying out this invention is shewn in partial sectional elevation,—the arrangement being suited for a building containing five stories. A, A, is the vapour-chest, in which is mounted a series of hexagonal or other shaped wire-gauze conductors *a, a,* set at an incline; the top one of which receives, from a hopper *b,* the wheat, rye, or other grain to be unbranned, passes it forward to a lower conductor, from whence it falls to a still lower one, and so on is passed out of the vapour-chest A, into a hopper *c.* These conductors *a, a,* are made to revolve slowly by means of straps and pulleys, as shewn,—rotary motion being communicated thereto from any first mover through the driving-shaft *d.* This slow motion of the wire-gauze conductors admits of the wheat or other grain or seed being thoroughly exposed to the action of the steam contained in the vapour-chest, and supplied thereto by a pipe *e;* and thus the cohesion of the outer skin or bran of the grain, with the flouring part thereof, is in a great degree destroyed, as before-mentioned. The grain, when in this state, leaves the vapour-chest, and, falling into the hopper *c*, enters the attrition-box B, where it is intended to receive an amount of friction just sufficient to separate the bran from the seed. The peculiar construction of the attrition-box will be clearly understood on referring to the sectional representation. Its friction surfaces are formed of cast-iron, and consist of a concave and convex cone, placed one above the other, and spreading out laterally into a flat base: the concave is the "runner" or top surface, and the convex the stationary or bed surface. These cones are formed at different inclinations, so as to allow of a greater space between them, near their apex, than at their base;—the object being to permit a free entrance of the grain between the friction surfaces, and a gradual and equable distribution of the grain as it descends,—so that each seed shall receive the requisite amount of friction for removing the bran before passing out of the attrition-box. The runner, which is shewn in plan view at B^1, is mounted on a vertical shaft *f*, connected by any suitable gear with the driving-power of the mill; and, as it rotates the runner, the seed falls down the eye of the runner and is drawn in between the friction-surfaces, and rubbed grain against grain, until the outer coat or bran is removed: the seed then escapes at an opening in the side of the attrition-box, down a vertical channel *g*. This escape is regulated by a sliding-gate or shutter, which, the more it is depressed, admits of a greater amount of friction being put on the grain. On the contrary, if too much friction is given, the gate must be raised, to allow of a quicker escape of the grain. At the bottom of the channel *g*, the grain meets with an ascending current of air, passing up an inclined channel *h*, which is connected with the case of a rotating fan or blower C. By means of this blast of air a large portion of the bran and other extraneous matters is separated from the seed, which falls down the channel *l*, into a horizontal conducting-pipe *i*. In this pipe an Archimedean screw is mounted,—the blade thereof being in contact with the under-side of the pipe. Rotary motion is communicated to the screw, and as the grain descends the channel *h*, it is pushed forward into a box *i**. In this box is mounted one of a pair of pulleys, for actuating an endless chain of scoops or buckets *k*, which are intended to carry the grain upwards. As soon, therefore, as the grain is propelled by the screw into the box *i**, the buckets, which rotate simultaneously therewith (one driving-band and pulley being common to both), carry the grain upwards, and discharge it down a trough at the top of the building into a hopper *l*. The hopper *l*, is in communication with a hot-air chamber D, which is provided with wire-gauze cylinders or conductors, similar to those in the vapour-chest. Heated air is introduced into the chamber D, by a pipe *m*; and as the grain is turned over by the revolution of the gauze-cylinders, the moisture imbibed in the vapour-chest is driven off, and the grain is delivered in a dry state into a hopper *n*, leading to a second attrition-box E. This box is for the purpose of polishing the grain and completing the removal of the bran, if any should be still adhering to the grain. It is constructed in a manner very similar to the box C, and its runner is actuated by any convenient arrangement of gearing. When the grain has undergone the polishing operation, it is delivered out of the box into a vertical channel *o*, whence it descends an inclined channel *p*, and encounters a second blast of air from the case of a fan or blower F, in connection with the inclined channel *p*. The remaining bran and other foreign matters, such as garlic (which is frequently mingled with wheat), are thus driven off; such foreign matters, by the attrition and drying to which they have been subjected, having lost a great portion of their specific gravity, and become much lighter than the corn or other grain under operation. A trough *q*, attached to the lower end of the channel *p*, conducts the grain by the hopper *r*, to the mill G, where it is ground into flour. The meal should, as soon as delivered from the grinding surfaces, be bolted (the hopper-box, usually employed in mills, being dispensed with), to prevent the meal from absorbing moisture from the atmosphere. A convenient mode of obtaining the steam and heated air for carrying out the above-described process is shewn in the drawing. It consists of a cast-iron furnace H, which carries at its upper part a shallow boiler *s*, wherein steam for the vapour-chest is generated. The steam is passed off to the chest by means of the pipe *e*, before mentioned. *t*, is a worm or twisted pipe, placed within the furnace for the purpose of being highly heated. This pipe is open at one end to admit air through it, and at its other end it is connected to or forms part with the pipe *m*, before mentioned, which conducts the heated air to the chest D. It will be obvious that any other suitable means may be adopted for obtaining the steam and heated air, if thought desirable. To ensure the proper amount of friction in the attrition-boxes, and the speedy delivery of the grain, it may be well to provide the friction-surfaces with shallow radial grooves (as shewn in the diagram at B^2,), which will have the effect of turning the grain over, and urging it forward. As the object in using the friction surfaces is merely to rub the grain, care should be taken, in setting the runner, that sufficient space is left between the friction surfaces to allow the grain to pass through the attrition-boxes without its being crushed or broken.

The patentee claims the dressing or cleaning of wheat, rye, and other grain, requiring such operation, by the application thereto of friction, while the grain is in a moist state; and the after application of a current or currents of air and dry heat, for the purpose of separating extraneous or foreign matters from the grain and rendering the same fit for the operation of grinding. He also claims the arrangement of apparatus, as shewn in the drawing, for effecting the unbranning of wheat, rye, and other grain, and separating extraneous matters therefrom.—[*Inrolled February,* 1849.]

To William Wilkinson, *of Jarrow, near Gateshead, in the County of Durham, coke manufacturer, for certain improvements in the construction of coke ovens, and in the machinery or apparatus to be connected therewith.*—[Sealed 16th November, 1848.]

This invention consists, firstly, in improvements in the construction of coke ovens, whereby the supply of air necessary for the proper charring of the coal is distributed in a more equable manner than heretofore over and through the incandescent mass, and thus the yield obtained from a given quantity of coal is increased, and the quality of the coke produced improved. Secondly, in the application of machinery to the working of coke ovens, for the purpose of curtailing the expenditure of manual labour in carrying on the operation. Thirdly, in the means of applying the heat, dissipated during the carbonization of the coal, to the evaporation of saline solutions.

In Plate III., fig. 1, represents, in back elevation, two of a series or range of the improved coke ovens; one of the ovens being partly in section, the better to shew the construction thereof. The patentee first describes his improved application of machinery to the working of coke ovens, as it may be used in connection with the coke ovens of other constructions than that made according to the present invention. A, is a shaft, running parallel to the range of the ovens, and extending from one end to the other of the series. B, B, are the bearings by which the shaft A, is supported. C, C, are pinions mounted upon the shaft A, and capable of sliding thereon when required. These pinions gear respectively into rack-teeth on the rods D, which rods are sustained in a horizontal position by the guide-frames and rollers E, *e*, and severally carry, at their inner ends, an oblong cast-iron plate F. These plates, being placed in a line with each other, extend nearly across the oven, as shewn at figs. 1, 2, and 3; fig. 2, being a front view of the ovens, and fig. 3, a plan view of the same; the right-hand oven being in section. Openings G, (figs. 3, and 4,) are made in the masonry, to allow of the rack-rods D, entering the oven. The plates F, are attached to their rods from the interior of the oven, and are made to traverse from one end of the oven to the other by the pinion C, (in gear with the teeth of the rack-rod D,) being caused to rotate by a steam-engine or other suitable power. The object of this arrangement is to discharge the coke from the oven (when the operation of charring is completed) in a more expeditious way than heretofore; the plates F, by the motive power communicated to them, being gradually forced forward towards the front of the oven, and driving before them the coke on the floor of the oven, whereby the ordinary manual operation of withdrawing the coke is dispensed with.

From the foregoing arrangements it will be readily understood, that when the shaft A, is made to revolve, by any suitable power, the pinions C, C, will at once communicate a rectilinear motion through the rack-rods D, to the plates F, F, which, being forced forward, will drive the coke out of the oven at the front opening H, fig. 2. As, however, it will never be required to discharge all the ovens simultaneously, the pinions C, are made capable of sliding on their shaft, and by a common lever movement, so as to be disengaged from or brought into gear with the teeth of their respective rack-rods D, as desired.

The improvements in the construction of coke-ovens consist in arranging a set of flues, by means of which the air introduced into the ovens, to support combustion during the carbonization of the coal, may be divided and diffused over the surface of the ignited coke, and at the same time regulated in quantity to suit the quality of coke required to be manufactured. It is well known that a considerable loss is sustained in the ordinary way of manufacturing coke, by admitting the whole of the air, necessary to keep up combustion, at the door-way or front of the oven; for a current of air is thereby caused to pass over the front of the ignited coke, and by the said current a large portion of carbon is oxidized and carried off in the form of carbonic acid gas, and, consequently, lost to the manufacturer; but, by diffusing the air uniformly over the ignited coke, a considerable saving of the material under operation is effected.

At fig. 2, which represents a front elevation of two of the improved ovens, I, is the bottom or floor, one foot above the level of the ground; and J, is the door-way, extending across the full width of the oven. It is closed by a door, let down in front thereof by the means shewn in the drawing, or in any other convenient way. K, K, are air-flues, running parallel with the arch of the oven, as shewn in the sectional plan, fig. 3, and communicating with the interior of the oven by a series of lateral openings L, L, L, figs. 3, and 4, through which the air in the flues K, is admitted to the ignited coke. These flues, near the back of the oven, are connected together by a cross flue K*, (shewn by dots in fig. 3,) which is also provided with lateral openings for distributing the air over the coke. The size of oven which the patentee prefers using is, length fourteen feet by eight feet in width; the floor being raised one foot above the level of the ground, with an inclination to the front of six inches in the length of the bottom; and the perpendicular height of the side walls, up to the springer, being three feet; while the radius of the arch is four feet. The patentee remarks, that flues similar to those just described may, with advantage, be used in conjunction with the ordinary forms of coke ovens, for the purpose of distributing the air equally over the ignited mass.

The last part of the invention, which refers, as before stated, to the economic application of the heat given off during the operation of manufacturing coke, is shewn at figs. 5, and 6. Fig. 5, represents, in plan view, a range of twelve coke ovens, with an evaporating and crystallizing-pan (which is used for the manufacture of common salt) applied thereto; and fig. 6, is an elevation of the same range. A, A, are the flues leading from the ovens B, B, and connected with the flue C, (shewn by dots in fig. 5,) which runs underneath the evaporating-pan D. E, E, are two auxiliary furnaces, used for the purpose of keeping up the temperature of the flue C, and burning the combustible gases which are given off from the coke ovens. F, is a crystallizing-pan, and G, a receptacle or well into which the salt is collected. H, H, H, are furnaces attached to the crystallizing-pan, and intended to regulate the concentration of the liquor as circumstances may require. Fig. 7, represents, in end elevation, the range of ovens and pans shewn at figs. 5, and 6; and fig. 8, is a longitudinal section of one of these ovens.

The mode of operating with this apparatus in the manufacture of chloride of sodium is as follows:—The evaporating-pan D, is kept supplied with salt water from a reservoir or other convenient source; and, in order to apply the heat equably to the pan D, each alternate oven is discharged, at proper intervals of time,—the range being divided into three sections of four ovens each, and one section per day being charged. By this means the combustible gases liberated from each newly-charged oven are brought into contact with the heated flue of the next oven, which is in a more advanced stage of the process; and, by introducing a proper quantity of air to support combustion in the circulating flue, the whole of the combustible gases, or nearly so, are ignited. Q, Q, are apertures by which air is introduced, to support combustion at any required point in the circulating flue. Each of the ovens is provided with a damper R, by which the communication with the circulating flue C, is intercepted at pleasure. The two auxiliary furnaces E, E, are intended to keep up the temperature of the circulating flue, and at the same time to give the workman a control over the evaporating-pan. When the liquor or brine is sufficiently concentrated in the evaporating-pan, a portion of it is discharged into the crystallizing-pan, by means of the connecting-pipe S, (figs. 5, and 7,); and the liquor is purified by well-known means, before precipitating or crystallizing the salt by a further concentration of the said liquor by means of the furnaces H, H.

The patentee claims, as his improvements in the construction of coke-ovens, the forming, in the walls thereof, flues with lateral openings, for the purpose of supplying air to the interior of the oven, and equably diffusing it over the surface of the ignited mass, as above described. And, with respect to the machinery and apparatus connected with coke-ovens, he claims the mechanical means, above described and shewn in the drawing, or any analogous arrangement, for discharging the coke from the ovens. And further, he claims the mode, hereinbefore described, of economizing the heat given off from coke-ovens during the manufacture of coke, and applying it to the evaporation of saline solutions.—[*Inrolled May,* 1849.]

To Edward Schunck, *of Rochdale, in the county of Lancaster, chemist, for improvements in the manufacture of malleable iron, and in treating other products obtained in the process.*—[Sealed 29th November, 1848.]

The first part of this invention relates to the manufacture of malleable iron from tin-plate scrap, which scrap consists of thin strips of plate-iron, covered with tin, being the refuse and clippings obtained in the manufacture of articles from tin-plate, or old articles of the same material, rendered useless by wear.

The presence of the tin has hitherto rendered tin-plate scrap unfit for the manufacture of iron; but, by the present invention, it is proposed to remove the whole of the tin from the surface of the plate before such is manufactured into malleable iron. By any one of the following processes the separation of the tin of the plate-scrap from the plate-iron may be effected:—

Process I. The tinned plate-scrap is placed in a boiling or hot solution of an alkaline sulphuret, containing an excess of sulphur; and of this class of substances the persulphuret of sodium is preferred, made either by dissolving sulphur in a solution of caustic soda, or by fusing sulphur with carbonate of soda, or by any other of the well known methods of producing persulphuret of sodium. The excess of sulphur in this persulphuret changes the metallic tin into a sulphuret of tin; which sulphuret of tin is dissolved by means of the sulphuret of sodium (deprived of its excess of sulphur), forming a compound variously denominated by chemists as stannosulphuret of sodium and sulphostannate of sodium. By this process the iron is rendered perfectly free from the coating of tin.

Process II. The tinned scrap is placed in a solution of oxide of lead in caustic potash or soda ley. During this process the tin becomes converted, by the action of the oxide of lead in the solution, into oxide of tin, which dissolves in the caustic potash or caustic soda, forming stannate of potash, or stannate of soda; while metallic lead is precipitated from the solution in the shape of a black powder. It is immaterial, as far as regards the ultimate effect, whether the solution of oxide of lead in caustic potash or soda ley be employed in a boiling state, or merely warm, or cold; but the process goes on with much greater speed when the solution is employed at a temperature nearly approaching ebullition, than when cold. By this process the iron is obtained nearly free from tin.

Process III. The tinned scrap is placed in a solution containing a chromate of an alkali and caustic alkali, when the metallic tin becomes converted, by means of the chromic acid of the alkaline chromate, into oxide of tin, which dissolves in the excess of alkali, forming a stannate of the alkali, while chromic oxide is precipitated, and the iron is left nearly free from tin.

Of these processes the patentee prefers the first, in consequence of the inconvenience experienced from the precipitated metallic lead of the second process, and the precipitated chromic oxide of the third.

The iron, deprived of its coating of tin by either of the above processes, is washed well with water, in order to remove the excess of the solutions employed, which may adhere to it; and, in case the second or third process is used, to remove the precipitated metallic lead, or precipitated chromic oxide mechanically adhering to it. After allowing the liquor to drain, the pieces of scrap-iron are packed closely in cylinders or pipes of sheet-iron,—each pipe having a capacity of about one cubic foot, and being made to contain, by means of a slight degree of compression, about 80 lbs. weight of material. A pipe thus filled with scrap-iron is placed in the fire, and when brought to a welding heat it is removed therefrom, and subjected to hammering in the way usually employed for making bar-iron: this process of heating in the fire, and hammering while hot, is repeated until the whole mass becomes uniformly solid.

Under this head of his invention the patentee claims the use of alkaline sulphurets, of solutions of oxide of lead in caustic alkalies, and of the chromates of alkalies with caustic alkalies, for the separation of the tin from the tinned iron plate. And he also claims the use of iron obtained from tinned iron-scrap by any of the above processes for the manufacture of malleable iron.

The second part of the invention relates to the recovery of the tin from the solutions employed for separating it from the iron, as described in the first part of the invention. The alkaline stannosulphuret obtained by the process first described is very soluble. This solution is boiled down in iron vessels until a drop crystallizes on cooling. The whole is then allowed to crystallize, and the crystals are drained on strainers, made of iron wire gauze. The crystals are next subjected to pressure, in order to squeeze out as much of the liquid which angs about them as possible; after which they are placed in reverberatory furnace, such as is generally used for the smelting of tin ores. By the application of a low heat in this furnace the crystals are completely dried and slowly roasted; by which means the sulphur of the sulphuret of tin is partly driven off and partly burnt,—the sulphuret being changed thereby into oxide of tin. Then upon the roasted mass a mixture of small coal, charcoal, or any other carbonaceous substance, with dry carbonate of soda or quicklime, is thrown; and, the heat being raised in the furnace, the oxide of tin is reduced, and metallic tin obtained, which is run off through a hole at the bottom of the furnace. The slack which is left in the furnace is raked out; and, as it consists principally of alkaline sulphuret, it is dissolved in water; and, after an addition of fresh sulphur, it is suitable for being again used to strip fresh quantities of scrap-iron of its metallic tin. The solutions of alkaline stannate obtained by the second and third processes are boiled down in iron vessels until crystals of the alkaline stannate are deposited; which crystals, as they form, are removed by means of an iron scoop, perforated with holes, and are placed, as before, on iron wire-gauze strainers to drain: the crystals are then pressed, and mixed, while still moist, with small coal, charcoal, or any other carbonaceous substance, and placed in a reverberatory furnace. By the application of heat, in the usual way, metallic tin is obtained, which is drawn off as before. The slack consists in this case principally of carbonate of soda, which is dissolved in water, and rendered caustic by means of quicklime; and, by adding to it either oxide of lead or an alkaline chromate, a liquor is obtained suitable for stripping the tin from fresh quantities of tinned plate, as before.

Under this part of the invention the patentee claims the use of sulphurets and oxides of tin, obtained from refuse or scrap tin plate (by any of the processes above described), for the purpose of obtaining from such sulphurets or oxides metallic tin, or for any other purpose to which such sulphurets or oxides may be applicable.—[*Inrolled May,* 1849.]

To Michael Loam, *of Treskerley, in the parish of Gwennap, in the county of Cornwall, engineer, for improvements in the manufacture of fuzees.*—[Sealed 11th January, 1849.]

This invention consists in improving the manufacture of fuzees, for mining and other purposes, by introducing calico or other flexible fabric or material therein, for the purpose of forming an internal tube to receive the powder and to enclose the same, and thus to produce a continuous train.

In Plate II., fig. 1, is a front elevation of the apparatus employed by the patentee for making fuzees; fig. 2, is a longitudinal vertical section thereof; and figs. 3, 4, and 5, are detached views of parts of the apparatus. *a*, is a reel, on which is wound a strip of calico or other flexible fabric or material *b*, of a width proportioned to the quantity of powder desired to be enclosed in the internal tube of the fuzee; from the reel *a*, the strip *b*, passes under the bent spring *c*, (see figs. 2, and 3,) and through the trough *d*, beneath the hopper *e*; and the strip is thereby bent into the form of a trough, and receives a supply of gunpowder from the hopper *e*, which is open at the bottom. The strip is then to be formed into a tube, which is partly effected by means of the projecting point *f*, at the bottom of the hopper *e*, and the instrument *g*, (see figs. 2, 4, and 5,): the instrument *g*, is caused by the weight *h*, to bend one edge of the fabric in towards the other edge, and thus partly form the tube. The partly-formed tube next passes through a tube *i*, which is fixed within the hollow axis *j*, in such manner that the tube will remain stationary while the axis revolves; and the end of the tube which is furthest from the hopper is made smaller than the other, and is split into three portions, which have a tendency to spring towards the centre: by this arrangement, as the strip passes through the tube *i*, its other edge is pressed over that which was first folded down, and the tube is thus completed. The tube then passes through the screw-passage *k*, carried by the plate k^1, which is supported by, and is capable of sliding on, two pins *l*, *l*, affixed to the disc *m*. The disc *m*, is fixed on the axis *j*, and carries the axes of eight or any other suitable number of bobbins of yarn or twine *n*, *n*; the yarn or twine is conducted from the bobbins through holes in the screw-passage *k*, which is cut with eight threads to correspond with the number of bobbins; so that the threads of yarn or twine will be laid correctly, side by side, upon the tube (as shewn at b^1, fig. 2,) when the axis *j*, with the disc *m*, plate k^1, and bobbins *n*, are made to revolve. The axis *j*, is caused to revolve by turning the handle *o*, on the end of the axis *p*; this axis *p*, carries a mitre-pinion *q*, which drives a mitre-pinion *r*, fixed on the same axis as the toothed-wheel *s*; and the wheel *s*, gears into a pinion *t*, fixed on the axis *j*. The tube b^1, is received from the apparatus upon a drum; and waterproof coating is to be applied, as heretofore, when employing twine only in forming fuzees known as the miner's safety fuzees.

In place of only lapping the yarn or twine round the tube in one direction, the thread may also be lapped round in the opposite direction. When lapped round in one direction only, the patentee generally causes the tube, in its way from the screw-passage *k*, to the receiving-drum, to be twisted in the direction in which the lapping takes place; and this he accomplishes by mounting the axis of the receiving-drum in a frame, carried by another revolving axis. Sometimes, instead of yarn or twine, the patentee uses tape for lapping round the tube: in that case he employs only one bobbin; and, instead of eight holes, he forms one opening or slit at an angle across the screw-passage *k*.

The patentee claims the means of manufacturing fuzees, for mining and other purposes, by employing calico or other flexible fabric or material to form progressively an interior tube of fuzees, as above described.—[*Inrolled July,* 1849.]

To GEORGE WILLIAMS, *of Tipton, in the county of Stafford, forge manager, for a certain improvement or certain improvements in preparing puddling furnaces used in the manufacture of iron.*—[Sealed 13th January, 1849.]

THE improved mode of preparing puddling furnaces, which constitutes this invention, is illustrated by the sectional figure in Plate III. *a,* is the fire-place; *b,* is the fire-bridge; *c,* is the flue-bridge; *d,* is the furnace, in which the iron to be puddled is placed; and *e,* is the opening through which the iron is introduced into and removed from the furnace, and through which the tools for stirring the iron are introduced. The furnace *a,* consists of a frame of cast-iron, on which plates of cast-iron, to form the sides and bottom of the same, are placed. Before using a puddling furnace, it is prepared by the introduction of roughly pulverized iron ore or scoria, which is accumulated against the sides of the same, as indicated by the thick lines: this iron ore or scoria defends the plates of the sides and bridges and the bottom of the furnace from the action of the melted iron; but a portion of the melted iron collects in the interstices between the particles of iron ore or scoria, from which it cannot be removed; and a loss of iron therefore results.

The improved method of preparing puddling furnaces consists in reducing the iron ore or scoria to a finely pulverized state, mixing the same with water, working or tempering to the condition of tempered clay, and moulding it into bricks or pieces of any suitable shape. The bricks or pieces are burned or baked; and they are then used for lining or coating the interior of the puddling furnace, as indicated by the dotted lines,—a mortar or cement, formed by mixing powdered iron ore or scoria with water, being introduced between the bricks or pieces. The patentee does not limit himself to the precise method above described of carrying out his invention, as the same may be varied: for example, instead of making a paste or clay, by mixing the powdered iron ore or scoria with water, and forming the same into bricks, which are afterwards built into the furnace,—the paste or clay may be formed into plates or slabs, of sizes and forms suitable for lining the several sides of the furnace. Neither does he limit himself to the materials above mentioned (*i. e.* iron ore or scoria), as the invention is applicable to the preparing of puddling furnaces, whether the said iron ore or scoria or any other suitable substance be used. He claims the method, above described, of preparing puddling furnaces: that is to say, by reducing the iron ore or scoria or other substance, with which the furnace is to be prepared, to fine powder, and making therewith a paste or clay; which paste or clay is fashioned into bricks or other pieces, with which an interior lining to the furnace is built.—[*Inrolled July,* 1849.]

To CAREY MC CLELLAN, *of Larch Mount, in the liberties of the city of Londonderry, for an improved corn-mill.*—[Sealed 16th January, 1849.]

THE first part of this invention consists in a mode of introducing air between the stones of corn-mills, for the purpose of keeping the same and the corn and meal in a cool state.

In Plate II., fig. 1, exhibits a vertical section of a pair of mill-stones, with the apparatus for introducing air applied thereto. *a,* is the running-stone; *b,* is the bed-stone; and *c,* is the hopper for supplying the stones with the corn to be ground. *d,* is the "damsel," which the patentee makes hollow, and furnishes with four or any other number of hollow arms *e,* radiating towards the circumference of the eye of the running-stone *a*;—the eye of the running-stone is enlarged or rounded at the bottom, so as to direct the air beneath the stone; but to this the patentee does not make any claim, as it has been done before. *f,* is a pipe or nozzle, fitted on the top of the damsel, in such manner as to allow of the latter revolving freely below; such pipe *f,* being provided with a valve *g*, for regulating the supply of air to the stones from the air-pipe *h*; through which pipe a continuous current of air is forced by an ordinary fan or other blowing apparatus. When the stone *a*, and the damsel *d*, are set in motion, and air is forced through the pipe *h*, by the blowing apparatus, the air will be distributed by the branch pipes or hollow arms *e*, between the grinding surfaces of the stones, and will keep the stones and the meal or flour in a cool state.

The second part of the invention consists in dispensing with the ordinary hopper, and feeding the mill through the hollow damsel. Fig. 2, exhibits the mode of applying an ordinary pipe and cup-feeder to the hollow damsel, without interfering with the arrangements for forcing air between the stones. The pipe or nozzle *f*, containing the valve *g*, instead of being placed immediately on the top of the revolving damsel, is placed on one branch *i*, of a bi-forked tube *i*, *j*, which is stationary; and the head of the damsel revolves immediately below it. The stem *k*, which supports the cup *l*, rises into the branch *j*, of the tube *i*, *j*. *m*, is the ordinary feed-pipe, which is adjusted to deliver the required quantity of corn into the cup *l*, by the regulator *n*.

The patentee claims, Firstly,—the improved mode of forcing and directing air by means of a blowing apparatus,—driving it into branch radiating and revolving pipes, which distribute the said air between the stones or grinding surfaces of corn-mills, as above described. Secondly,—the improved mode of arranging the ordinary pipe-and-cup feeding apparatus, so as to use it in combination with the improved mode of forcing and directing the air, as above described; whereby he is enabled to throw the matter to be ground more directly between the stones or grinding surfaces; inasmuch as, by this arrangement, it follows the course of the air through the radiating arms.—[*Inrolled July*, 1849.]

To CHRISTOPHER NICKELS, *of the Albany-road, in the county of Surrey, Gent., for improvements in preparing and manufacturing India-rubber* (*caoutchouc*).—[Sealed 11th January, 1849.]

THE first part of this invention consists in improvements in the machinery used for grinding, kneading, or masticating India-rubber.

In Plate II., fig. 1, is a transverse section, and fig. 2, a longitudinal section of a grinding, kneading, or masticating machine. *a*, is a closed trough or cylinder, in which the kneading process is carried on; and the patentee prefers that the cover a^1, should be a close cover, when sulphur is to be applied to the India-rubber; but when only the ordinary process of kneading or masticating the India-rubber is to be carried on, an open or framed cover may be used. *b*, is the kneading or masticating roller, formed with flanges b^1, on its ends, by which the India-rubber is prevented from coming against the ends of the cylinder *a*; and it is the application of flanges to the roller *b*, which constitutes one of the improvements. Fig. 3, is a vertical section of another kneading or masticating machine, in which the roller *b*, is provided with flanges b^1, as in the preceding machine; but, in addition thereto, the roller *b*, is placed and works excentrically in the cylinder *a*; which will be found very advantageous (whether the roller *b*, is made with flanges or not) when combining sulphur or other matters with India-rubber at the time of kneading or masticating.

The second part of this invention consists in certain means of combining sulphur, or matters containing sulphur, with India-rubber, so as to produce a new manufacture of India-rubber, suitable to be made into sheets, threads, and other articles.

When India-rubber is combined with sulphur and other matters, a "change" is produced, which causes it to retain its elasticity under great variations of temperature; but when such change has been produced, the pieces of India-rubber cannot be masticated or kneaded into a mass; nor will thread, made thereof, join by contact of raw surfaces, as the thread made of India-rubber, which has not been subjected to such change, will do. By the patentee's process, he obtains a manufacture of India-rubber, combined with sulphur or matters containing or compounded of sulphur, which will possess greater permanence of elasticity, when subjected to various degrees of temperature, than natural India-rubber; yet the same may be ground, kneaded, or masticated; the thread made therefrom will join or "piece-up" by contact, like thread made from natural India-rubber; and when such thread is made up in fabrics, the fabrics may be boiled without injury to the India-rubber thread.

The patentee prepares the India-rubber by kneading or masticating therewith powder or flowers of sulphur, or matters containing sulphur, in the proportion of about ten pounds of sulphur to sixty pounds of India-rubber; and he then sub-
s the India-rubber to pressure in moulds, in the manner

in which kneaded or masticated India-rubber, in the natural state, has heretofore being treated.—This process of subjecting India-rubber (combined with sulphur or matters containing sulphur, and in which the "change" has not taken place) to pressure in moulds is an important improvement in the manufacture; for, by so treating India-rubber, a close compact mass or block is obtained, which can be cut into sheets or thread. The patentee prefers to treat India-rubber with the fumes of sulphur or gases or matters containing sulphur; and he uses for this purpose the kneading or masticating apparatus above described, together with the apparatus shewn in section at fig. 4, consisting of a retort *c*, to contain the sulphur, heated by a fire below, and connected with the kneading or masticating machine by the pipe *d*, through which the fumes of sulphur pass, in order to act upon the India-rubber in the cylinder *a*. When treating India-rubber with fumes of sulphur, the patentee has found it advantageous to introduce hydrogen into the cylinder *a*, of the kneading or masticating machine, through the pipe *e*; or, in place thereof, to use very small quantities of phosphorus, either in small particles or in a state of vapour; and he prefers to heat the cylinder *a*, by a steam-jacket or other suitable means. The mass thus produced is to be subjected to pressure.

In order to obtain a more perfect blending of the sulphur with the India-rubber, the patentee takes the blocks from the moulds, in which they have been allowed to cool and set, and subjects the same to such action as will give motion to the particles thereof: the patentee here remarks that, in subjecting India-rubber combined with sulphur to pressure in moulds, he prefers to use hydraulic pressure; and he heats the moulds to from 220° to 250°, by a steam-jacket or other suitable means, whilst applying the pressure, and until the degree of compression has been obtained. Fig. 5, exhibits a sectional elevation of the machine for acting upon the moulded blocks. It consists of two plates *f*, *g*, between which the blocks of India-rubber *h*, are placed; and the upper plate *g*, which carries the weights *i*, *i*, is caused to move to and fro by the connecting-rod *j*, attached to a crank on the shaft *k*, to which motion is communicated from a steam-engine or other prime mover: by this means, the blocks of India-rubber will be caused to roll, and will, at the same time, be pressed on, so as to put every part in motion; and the effect of this motion will be to equalize the sulphur in the blocks. When thread, made of India-rubber combined with sulphur, is to be operated on to equalize the sulphur, the thread is placed in a box, which is heated by steam or other suitable means, and receives a quick vibrating motion; all the particles will thereby have a quick tremulous motion imparted to them, which the patentee has found to act very beneficially. He has also found that ordinary India-rubber thread, when placed in such a box with flowers of sulphur, and so treated, is greatly improved: the sulphur penetrates the surface, and produces a coating or glaze thereto.

The patentee claims, Firstly,—constructing the kneading-rollers with flanges, as above described; and also causing the kneading-rollers to work out of the centre of the cylinder or trough. Secondly,—the manufacture of India-rubber by combining therewith sulphur or matters containing sulphur or products of sulphur, by grinding, kneading, or masticating the same, in a manner suitable for making elastic thread or sheets and other articles, and yet retaining the property of piecing up and of kneading or masticating; also the combining of sulphur fumes with India-rubber, when grinding, kneading, or masticating; and likewise the combining of sulphur or matters containing sulphur or products of sulphur with India-rubber, when kneading or masticating the same with phosphorus.—[*Inrolled July,* 1849.]

To Francis Hobler, *of Bucklersbury, in the City of London, Gent., for improvements in the construction of the cylinders or barrels of capstans and windlasses.*—[Sealed 11th January, 1849.]

This invention consists in constructing the cylinders or barrels of capstans and windlasses with curved grooves in the surface thereof, varying in size according to the size of the cables to be used therewith.

In Plate III., fig. 1, exhibits an elevation of a capstan, constructed according to this invention; fig. 2, is a horizontal section of the same; fig. 3, is an elevation of a windlass; and fig. 4, is a transverse section of the windlass-barrel. The cylinders or barrels are represented in the drawings as being made of wood, with iron (or other suitable metal) forming portions of the surface; but the whole surface may be composed of metal, if desired. *a, a,* are curved grooves, which correspond laterally with the size and figure of the links of a cable that are to enter the grooves; and the space between the grooves corresponds with the size of the intervening links: a capstan or windlass-barrel, thus made, will possess greater holding power than one of the ordinary construction. Although the grooves in the barrel are made suitable to receive the links of the largest cable to be used therewith, yet cables having somewhat smaller links may be used.

The patentee says, that he has not thought it necessary to shew complete capstans or windlasses,—the construction of the parts omitted being well known. He states, however, that, in addition to the ordinary parts, he prefers to use Caldwell's patent self-fleeting apparatus and purchase and purchase-wheel; but, instead of using such purchase and purchase-wheel, holes may be formed in the barrel for the reception of handspikes, as indicated by the dotted lines at *b*, *b*. When capstans and windlasses, constructed according to this invention, are used, the cable should be caused to take three turns round the barrel.

The patentee claims the construction of capstan and windlass cylinders or barrels with curved grooves, as above described.—[*Inrolled July,* 1849.]

To JOHN BETHELL, *of Parliament-street, in the City of Westminster, Gent., for improvements in preserving animal and vegetable substances, and also stone, chalk, and plaster, from decay.*—[Sealed 21st August, 1848.]

To preserve wood and timber, according to this invention, the patentee dries or seasons, or dries and smokes the wood in the manner hereinafter described; he also preserves the wood by saturating it (either without first drying it, or after it has been dried, or dried and smoked) with the antiseptics hereafter mentioned; but for some purposes one process only is necessary. In the following description, the modes of drying and smoking will be first explained, and afterwards the modes of saturating the wood with the antiseptics.

The modes of drying and smoking are described under the three following heads:—

First. A close chamber or drying house, composed either of iron or of brick or stone set in cement, is provided; and connected with it are flues, proceeding from a furnace-fire and running round the bottom of the chamber, for the purpose of conveying the smoke and hot vapour from the burning coke or fuel into the chamber. From the top of this chamber a pipe proceeds to an air-exhausting apparatus, which may be of any usual construction. The wood being put into this chamber, and the fire lighted in the furnace with coke or any other fuel, and the chamber closed, the air-exhausting apparatus must be set to work, which will draw off the moist vapour as it is exhaled from the wood; and the heated carbonic acid gas and smoke from the fire will pass through small openings, made in the flues at the bottom of the chamber, and up through the chamber; thereby heating all parts of the wood, and impregnating it with the gas and smoke of the fuel: the surplus of smoke is ultimately drawn out of the chamber at the top by the exhausting apparatus. By this means, the wood becomes gradually heated and impregnated with the gas and smoke of the fuel, and the moisture evolved from the wood is drawn off. The temperature of the chamber is easily governed by working the exhausting apparatus, either faster or slower, and by the quantity of fuel in the furnace. The degree of heat in the chamber should range from 100° to 200° Fahr., and the time that the wood may be required to remain in the chamber must depend on its size and condition.

Second. As a further preservative to the wood, the patentee introduces into the furnace-fire of the above drying-chamber, materials which will give off a considerable quantity of smoke or gas, of a more antiseptic nature than the ordinary smoke or gas of coals and coke. For this purpose, he runs into the fire small streams of coal-tar or heated coal-tar pitch, or puts on the fire, at once, a large quantity of peat, or oak, birch, or beech wood, so that the fire may be partially smothered by it, and a considerable quantity of smoke be generated from the peat or wood, which will then impregnate the wood or matters placed therein, and preserve them.

Third. The preserving and drying the timber in the chamber may be effected by heating the interior of the chamber and the materials therein by a current of dried or heated steam, which is obtained by simply passing steam, generated in the usual way, through a series of heated or red-hot pipes, or such other contrivances as are now used for heating air for the hot blast, and therefore well known. This steam, on being introduced through the bottom of the chamber containing the wood or other articles, will pass up through the chamber, and make its exit by a pipe at the top, as before described. An opening is also made from the external air to the chamber, close by the steam-pipe; and which must furnished with a valve or cock, to allow the workman to in a portion of cold air to mix with and reduce the temperature of the dried or heated steam, if necessary. By this arrangement, any heat, from 100° to 500° Fahr., can be obtained; and, in order further to preserve the timber, the patentee passes this dried or heated steam through the antiseptic materials described below, under heads Nos. 1, 2, 3, 4, 5, 6, 8, and 9, so that it may take up and carry with it some of the vapour from those materials into the chamber to impregnate therewith the articles therein. For many purposes, as for work in the interior of houses, wood dried, or dried and smoked, according to either of the three modes above described, will be sufficiently preserved; but, to preserve it for a longer period, the wood is saturated with the antiseptics hereafter named. If the wood is green and wet, then, before it is saturated, it is dried and smoked, as above described; but if it is tolerably dry and seasoned, the drying or smoking process is dispensed with. Short lengths of timber may be saturated with the antiseptics by putting them into open tanks, filled with either of the antiseptics hereafter named, in which the liquid is kept at a temperature as near to 200° Fahr. as can be obtained, by blowing high-pressure steam from a steam-boiler into the liquid, or by heating the tanks in any convenient manner, so that the wood may be nearly boiled in the liquid. The wood is kept in the liquid until it has absorbed about eight pounds of liquid to each cubic foot of wood. For long lengths of timber, the patentee prefers first drying, or drying and smoking, and then impregnating them with the antiseptics, hereafter named, in the tanks now well known under the name of pressure-tanks, in which the air is first withdrawn from the wood by an air-pump, and the liquid is then forced in by an hydrostatic forcing-pump, at a pressure of full 160 pounds to the inch. It is preferred that the liquid should be first heated to 160° before it is pumped into the tank.

The antiseptic materials employed are described under the following numbers:—No. 1. Any bituminous or tarry oils, obtained by the distillation of either bitumen, tar, or bituminous shale, or bituminous sand-stone, and particularly the following, viz., No. 2. The tar or pitch-oil, made under the patent granted to Mr. Samuel Clift, December 8th, 1846,* may be used either alone or mixed with other tar or bituminous or resinous oils. No. 3. The oils obtained by the distillation of tar or bitumen, particularly the heavy oil of coal-gas tar. No. 4. The native petroleum or mineral oil, which is found in some coal mines, or exuding from some bituminous rocks;

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* For specification of this invention see Vol. XXXI., p. 114, Conjoined Series.

and also the oils obtained by distilling this native mineral oil or mineral tar. No. 5. The fatty oil obtained by the distillation of resin. No. 6. A mixture of all or any of the above oils. No. 7. Melted resin, kept hot, and thinned when necessary with either of the above oils. No. 8. Sulphur, dissolved in either of the above oils, and used in the proportion of about one pound of sulphur to every gallon of oil; but, as an antidote to the ravages of the sea worm, the patentee uses the heavy oil of gas-tar, with one pound of sulphur, dissolved by heat, in each gallon of oil. No. 9. The rough pyroligneous acid, obtained by the destructive distillation of wood. No. 10. Rough pyro-acetate of copper, which may be made by steeping sheets of old copper in pyroligneous acid, or by mixing together solutions of sulphate of copper and pyrolignite of lime. No. 11. A strong solution of bark,—the bark of larch and oak being preferred.

The antiseptics described under 9, 10, and 11, will be sufficiently preservative when the wood is not to be exposed to the action of wet weather; but when the wood to be prepared is intended for out-door work, the antiseptics described under either Nos. 1, 2, 3, 4, 5, 6, 7, and 8, should be used; and to enable it to resist the attacks of marine worms, either Nos. 1, 2, 3, 4, 5, 6, or 8, must be employed; but No. 8, is preferred. The wood must be first dried, or dried and smoked, and then thoroughly impregnated in the pressure-tank, above described, in order that it may absorb sufficient of the oil and sulphur to preserve it against the worms.

For preserving corn and grain of all sorts, the patentee employs heated steam, as described under the third head; for which purpose, the grain must be placed on trays in the hot chamber above described; the bottoms of which trays must be made of wire-gauze or hair-cloth, so that the dried or heated steam-current, mixed (if necessary) with the external atmospheric air, admitted through the opening described, may pass up through the bottom of the trays, and through the grain out at the top of the chamber; or the grain may be made to pass through a revolving cylinder of perforated metal, or of wire-gauze, placed in a close oven or chamber, which may be heated by a fire of coke or charcoal, or by a current of the aforesaid heated steam passing freely through it. Or grain, pulse, seeds, or berries, may be preserved by drying them in the machine or apparatus shewn in Plate I; wherein fig. 1, represents a side elevation, and fig. 2, a longitudinal vertical section of the same. The apparatus consists of a square or other conveniently-shaped box *a, a,* in which are placed a series of endless cloths *b, b,* mounted on rollers *c, c,* and made to travel with a constant and uniform speed. The grain, pulse, seeds, or other matters to be operated upon, are fed into the apparatus through a hopper *d,* which is furnished with a small fluted roller *e,* for the purpose of keeping up a constant and regular supply of the matters to be dried or preserved, and which fall from the exit aperture of the hopper on to the first and uppermost endless cloth or belt *b;* whereby they are carried slowly onward to the opposite side of the box, where they are allowed to fall on to a second cloth or belt, which is travelling in the opposite direction. The grain or matters to be operated upon are thus carried backwards and forwards across the apparatus several times, until they ultimately fall into a spout f^1, which conveys them from the apparatus into any convenient receptacle. While the matters are thus slowly passing through the apparatus, a current of heated steam is admitted into the interior by the pipe *g,* and diluted, if necessary, with some atmospheric air, let into the box through the pipe *n.* The steam, after acting on the matters on the travelling cloth, escapes from the apparatus, together with the vapours arising from the operation, by the exit-pipe or flue *h.* It should be observed, that the axle of one of each of the pairs of rollers *c, c,* carries a pinion or toothed wheel *i,* which gears into corresponding wheels on the axles of the rollers, immediately above and below, as shewn best in the side elevation; and that motion is communicated to the whole train by a pinion *j,* on the fly-wheel *k,* which is driven by hand by the crank *l,*—the pinion *j,* being made to gear into a toothed wheel *m,* on the axle of one of the rollers.

To preserve meat for food, the patentee takes one gallon of wood naphtha, or fine pyroligneous or pyro-acetic spirits, or very fine pyroligneous acid (but he prefers that which is commonly called wood naphtha), and mixes it with from two to four gallons of water, in which common salt has been dissolved in the proportion generally used for brine; with this liquid the fresh-killed meat is impregnated, by preference, by injecting the arteries and veins with the liquid; for which purpose, the animal should be killed by stabbing it in the heart, that the injection of the arteries and veins may be made by pumping the liquid into them through the main artery and vein connected with the heart (a process well known to all surgeons and anatomists). After the liquid has been thus injected, the carcass will keep fresh and good for a considerable time; but to preserve it for long voyages, it must be cut up and put into a barrel full of salt brine, of the usual strength, and the barrel closed up. It will not be necessary to use so strong a brine as is now done,—the meat will therefore be much less hard than the present salt meat, and will, in fact, be more like fresh meat, when cooked. Or, instead of packing the meat, so impregnated, in barrels full of brine, it may be put into strong iron barrels or cases, closed up and charged with compressed carbonic acid gas, of the density of about thirty pounds to forty pounds to the square-inch pressure; or the meat may be cut into pieces, without being impregnated as above described, and packed in cases full of the above mixture of one part of wood naphtha or pyroligneous acid and four parts of salt water, which will keep it fresh a long time, but not so long as that which has been impregnated and afterwards packed in brine. Meat may also be prepared by cutting it into thin strips, steeping it first in the mixture of wood naphtha or pyroligneous acid and salt, as above described, for about eight or ten hours, and then drying it in the hot chamber by the current of the dried or heated steam and air, at a temperature not exceeding 170° Fahr.

In many places large quantities of animal matters can be obtained, which would be very useful for manure, if they could be sufficiently preserved from putrefaction; so that they might be conveyed to the farms, and kept there until wanted. To effect this useful purpose, the patentee preserves all kinds of animal matters, such as dead animals, sprats, and all kinds of fish, whale blubber, seals, &c., or the refuse of herrings, and of whales and seals, after the oil is extracted therefrom, by steeping them in the open tank, above described, filled with either of the antiseptics above described, under Nos. 1, 2, 3, 4, 5, 6, 7, 8, and 9, or with any kind of tar, or heated pitch, or bitumen. Small fish, or small pieces of flesh, it is only necessary to steep for two or three hours; but larger pieces must be kept in the tank eight or ten hours; after which time they are taken out, dried, and packed in any convenient packages, and sent away. Or the fish, or pieces of animal matter, may be put into casks filled with either of the liquid antiseptics above described, under Nos. 1, 2, 3, 4, 5, 6, 7, 8, and 9, or with any kind of tar, or heated pitch, or bitumen.

When used by farmers, the animal matter is to be cut or ground into very small pieces, and mixed with earth, ashes, or lime, and applied to the land in the same manner as dry guano is now used. The oil obtained by the destructive distillation of bones may be used as an antiseptic for this purpose; but, as the smell of it is very disagreeable, it should be mixed with some one or more of the antiseptics, or tar, pitch, or bitumen, lastly above named; although it is quite as good an antiseptic for this purpose, when used alone, as when so mixed; and when it is only desired to preserve the animal matter, so that it will keep but a short time, it will be found sufficient to put the animal matters, which it is desired to preserve for manure, into the hot chamber, as described under the second and third heads, and dry and smoke them therein in the same manner as above described for smoking wood.

The patentee preserves all kinds of malt liquors and wines by putting them into small barrels or vessels, made of metal, well tinned, and strong enough to bear an internal pressure of from 60 to 80 pounds on the square inch. These barrels are made, as shewn at fig. 3, of iron, well tinned. The liquid is put into the barrel at the charging-hole *a*, until the barrel is nearly full, when the charging-hole is closed by the screw; and a pipe, leading from an air-forcing pump, is then screwed on to the end of the cock at *b*, or to the charging-hole at *a*; and, by this pump, compressed carbonic acid gas is forced into the liquid in the barrel: part of which gas occupies the vacant space above the liquid in the barrel, and part is absorbed by the liquid,—thereby making it an effervescing drink. When it is desired to draw out any of the malt liquor or wine, the cock is opened, and the compressed gas forces out the liquid. The patentee states, that he is aware that malt liquors and wines have been heretofore bottled with carbonic acid gas forced into them; he therefore disclaims any invention in the preserving of malt liquors and wines, by charging them with carbonic acid gas; but what he claims is, merely the preserving them by putting them into strong barrels or vessels, like that shewn at fig. 3; from which small portions can be drawn out, without discharging the whole contents, and without injuring what is left in the barrel or vessel,—the liquid being forced out by the pressure of the gas in the barrel or vessel.

To preserve milk or cream, according to this invention, it is first scalded, and then impregnated with carbonic acid gas, in a soda-water machine. When the milk is charged with the gas, it is drawn off into bottles, and corked in the usual way. Or, instead of being put into ordinary bottles (from which, as soon as opened, the whole quantity of milk must be poured out), it may be put into strong metal barrels or cases (like that shewn at fig. 3,), or jars, or bottles, supplied with a cock or valve, attached to a pipe leading to the bottom of the barrel, case, jar, or bottle; so that, on opening the cock, a portion only of the milk may be drawn off at a time,—the pressure of the gas within the barrel, case, jar, or bottle, being sufficient to force the milk out; and, for keeping milk or cream a moderate time, it is sufficient to put the milk, after it has been scalded, into the metal barrels or vessels, and then force in the carbonic acid gas by an air-pump through the cock; or the milk or cream may be charged with carbonic acid gas by any other of the various means now well known for supplying carbonic acid gas to liquids. For milk or cream, the patentee prefers using carbonic acid gas made by the mixture of carbonate of soda and acid: the gas he washes in water before it is used; and he scalds or boils the milk before it is prepared.

Porous stones, chalk, and plaster, and all articles made therewith, may be preserved from decay, by first heating them in the drying-chamber or house above described, or in any kind of oven or kiln, and then steeping them, whilst hot, in tanks of hot tar or bitumen of any kind, or in melted resin, thinned, if necessary, with either of the antiseptic oils and materials above named under Nos. 1, 2, 3, 4, 5, and 7, to enable it to enter the pores. The articles must be kept in the tanks until they are saturated to the depth of half an inch or more, and then taken out and dried. When cold, the surfaces can be rubbed down, and, if desired, they can be painted any color.

The patentee claims, the preparing of the wood by drying, or drying and smoking it, according to the first and second modes above described; also the use of the dried or heated steam, as above described, for the drying and preserving wood, corn, and grain of all kinds, and strips of meat and animal matter of all kinds; also the preserving wood by saturating it with either of the antiseptic materials above described, under Nos. 2, 4, 5, 6, 7, 8, 9, and 10, by either or all of the modes above described, or by any other mode of saturation; but he disclaims the use of the antiseptics Nos. 1, and 3, for wood, except only when used in combination with the modes of saturation above described, and then he claims them; also, as part of his invention, the drying and preserving corn and grain, as above described, and the machine or apparatus described in the drawing for drying corn and grain of all kinds; also the preserving of meat for food, and the preserving of all animal matters, for the purpose of being used for manure, as bove described; also the preserving malt liquor and wines in the manner above described; also the preserving of milk and cream, by impregnating or charging it with carbonic acid gas, and keeping it in closed barrels, cases, bottles, jars, or vessels, as above described; and lastly, he claims the preserving of porous stones, chalk, and plaster, and articles made therewith, in the manner above described.—[*Inrolled February*, 1849.]

To Miles Wrigley, *of Ashton-under-Lyne, in the county of Lancaster, architect, for his invention of certain improvements in the manufacture of yeast or barm.*—[Sealed 11th January, 1849.]

This invention relates to the manufacture of yeast or barm, either in a solid or liquid state, applicable either for baking or brewing purposes; and consists in the method of obtaining such product by the admixture of certain compounds, hereinafter mentioned, in the proportions and in the manner below stated.

The principal advantages obtained by the application of this invention are stated as follows:—First, the yeast or barm, thereby produced, possesses a much greater power of fermentation than the kind hitherto in use, and, consequently, operates much quicker when combined with the flour. Secondly, the improved yeast or barm possesses a considerable tendency to collect moisture, which is very desirable; so that bread, fermented by it, will keep much longer than that fermented by the ordinary yeast or barm, and the bread, instead of being deteriorated, will be improved by keeping. Thirdly, the yeast or barm, thus prepared, will keep much better than that commonly used. And, Fourthly, ale or porter, fermented by the improved yeast or barm, will be found to be clearer, and to keep much better than that fermented by the ordinary barm, and will have the property of sparkling upon coming into contact with the atmosphere.

The first part of the invention consists in manufacturing yeast or barm according to the following formula:—Take of yeast or barm, produced by the fermentation of ale or porter, 100 pounds weight; of yeast or barm, produced by the fermentation of spirits (whether made by the distillation of malt or other grain, or from sugar, or molasses, or any other article which will produce yeast or barm), also 100 pounds weight; of malt, barley, oats, and rye, ground into flour, each one pound; of spirits of wine four ounces; and of water ten ounces, or as near such proportions as may be found efficient. The method of mixing the ingredients is as follows:—First mix together the brewer's and distiller's yeast or barm, and run the mixture through a sieve, in order to free it from any sediment or other impurities. Then mix together the spirits of wine and the water, and pour it on to the grain; at the same time adding as much of the yeast or barm as will make it into a thin paste: when this is well mixed, add it to the remainder of the yeast or barm, and stir it with a wooden spatula until the whole is well mixed. This forms the compound liquid yeast or barm for the use of brewers or bakers.

To manufacture the solid compound yeast or barm, strain the above mixture, and take the solid parts, in coarse linen bags, and place them in the interior of a perforated cylinder, in a common hydraulic, screw, or other press: upon applying pressure, the liquid parts will run off, and the solid parts remaining will form the solid compound yeast or barm.

Instead of the before-mentioned ordinary yeast or barm, a yeast or barm made from the fermentation of any one or more of the following materials will answer the same purpose, namely,—any kind of British or foreign fruits (either fresh or dried), or any other material containing saccharine matter, or sesqui-carbonate of ammonia, chloride of sodium, alum, tartaric acid, cream of tartar, carbonate of soda, and a variety of other materials which, by fermentation, will produce yeast or barm.

The patentee claims, First,—the method of manufacturing yeast or barm, either solid or liquid, by the admixture of the above specified ingredients; and, Secondly,—the application or use of an hydraulic or other press to such manufacture, in order to separate the solid from the liquid parts of the said yeast or barm.—[*Inrolled July*, 1849.]

To John Travis *and* John McInnes, *of Liverpool, in the county of Lancaster, lard refiners, for improvements in packing lard.*—[Sealed 21st December, 1848.]

This invention consists in the employment of a woven fabric for containing lard.

The patentees say they have found that fine and closely woven calico or muslin is best adapted for this purpose. They prefer that the package should resemble the bladder now commonly used for holding lard; for which purpose, they cut the fabric into oval-shaped pieces, having a prolongation at one end, to form the neck or opening through which the lard is introduced when in a fluid state; and they sew or secure two pieces together at the edges, and thus form a perfect bag with a narrow neck, ready to be coated with cement. The cement used for coating the bags is a mixture of animal gelatine with farina or starch paste, made of such a degree of consistency that, when hot, the bags may be well and easily worked in it. When the bags are well saturated with the cement, they are withdrawn, and any superfluous adhering cement is removed; they are then dipped into a cold saturated solution of common salt and alum, which has the effect of hardening the cement and preventing it from softening and coming off in the operation of filling the bags; and, after this treatment, the bags are turned inside out: they are then ready for use; but, if they are not wanted for use immediately, they should be kept in a moist state until wanted. The bags are filled and cooled in the same manner as the ordinary bladders.

Although calico or muslin is stated to be best adapted for the above purpose, the patentees do not confine themselves thereto, as other woven fabrics will answer; they do not confine themselves to any form or size of the bags or packages, although they prefer the bladder form; and they do not confine themselves to an internal or external coating of cement, or both, as they have found that it can be dispensed with; but they prefer to employ it. They claim the application of a suitable woven fabric, such as the one described, when made into packets or bags for the purpose of containing lard.—[*Inrolled June,* 1849.]

To HENRY F. BAKER, *of Boston, in the State of Massachusetts, one of the United States of America, for a certain new and useful improvement in steam-boiler furnaces.* [Sealed 22nd December, 1847.]

THIS invention consists in combining one or more reverberatory chambers or auxiliary fire-places, having air or oxygen ducts, with the usual fire-place of a steam-boiler; the object of employing the reverberatory chambers being for the purpose of retaining and revolving the volatile products which escape from the burning fuel, and supplying them with a suitable quantity of oxygen, in order thereby to obtain a more perfect combustion of such volatile products than has been effected in furnaces heretofore constructed.

In Plate III., fig. 1, is a vertical section of a furnace constructed according to this invention; and fig. 2, is a horizontal section, taken immediately below the bottom of the boiler, *a,* is the boiler; *b,* is a horizontal fire-grate; and *c,* is a vertical fire-grate, placed upon the back end of the grate *b,* and extending up to, or nearly up to, the bottom of the boiler, to prevent the fuel from falling into the first reverberatory chamber. *d, e, f, g,* are reverberatory chambers for the retention and burning of the gases and such other volatile products of combustion as escape from the main fire-place: the bottom surface of each chamber has an inverted parabolic or curved shape in its longitudinal and vertical section, as shewn at fig. 1; the said shape being for the purpose of deflecting the gases or volatile products upwards against the boiler, and giving to them a revolving motion. Between any two of the reverberatory chambers (to which it may be desirable to apply it) is placed an air distributor or shallow box *h,* or *i,* of plate-iron or other suitable material; the top plate of the said box is shaped to correspond with the curve of the bottom of the chamber *e,* or *g,* immediately in rear of it, and is pierced with numerous small holes through which air or oxygen is to be admitted into the chamber; and the box receives a supply of air through the passage *j,* which extends through the brick-work in any suitable direction into the atmosphere. An inclined partition *k,* is fixed between the vertical grate *c,* and the box *h,* for the purpose of receiving the main body of smoke and volatile products from the fire-place and deflecting them upwards against the boiler, and thereby causing them to sweep downwards and along the curved surface of the first chamber *d.* In the bottom of each reverberatory chamber there is a grate *l,* through which the fine dust and cinders or ashes, which are not destroyed by the heat generated in the chamber, fall into a receptacle *m,* that extends beneath all the chambers *d, e, f, g,* and is closed at both ends to prevent the admission of too large a quantity of air into the chambers. From the last chamber *g,* a flue is carried round the hind end of the boiler, and from thence to the chimney. Between the rear and front parts of any two chambers (to which it may be desirable to apply it) may be placed what the patentee terms a separator of the volatile products: it consists of two plates *n,* and *o,* forming together a throat or passage for the volatile products to rush through—any number of holes may be made in the plate *n,* through which the smoke and unconsumed volatile products will rush in so many streams; and the plate *n,* may or may not extend up to the boiler.

As the smoke, gases, or other volatile products, pass from the fire-place into the reverberatory chamber *d,* they are retarded and revolved therein and thrown upwards against the boiler, in consequence of the peculiar shape of the bottom of the said chamber; a portion will be burned in the chamber, and the remainder, or surplus, will pass over the top of the box *h*, and commingle with the air, which rushes through the openings in the same and supplies the quantity of oxygen necessary for the entire or partial combustion of the surplus; and owing to the inclined position of the perforated plate of the air-box, the air, which rushes through it, will impel the combustible and burning volatile gases and other products, in numerous jets or streams, against the part of the boiler which is over the plate. These jets of flame, in striking against the boiler, are to a great extent deflected by it against the rear curved part of the chamber, and by it reverberated or turned downwards and coursed back or towards the perforated plate of the air-box; and thus a rotation or revolution of the gases or volatile matters is kept up in the chamber. Such portions of the gases or volatile matters as are not consumed pass into the next and succeeding chambers, until, by being so revolved and supplied with fresh air, they become nearly, if not entirely, consumed.

In conclusion, the patentee says, that what he claims is, one or more reverberating chambers (made and arranged as above described) in combination with the fire-place and boiler —the same being made to revolve and retain the volatile products underneath the boiler long enough for them to be consumed. And he also claims the manner of arranging the air-distributing boxes, with respect to the bottom of the boiler, in combination with the curved deflecting bottoms of their respective chambers, in order that the flame produced by the combustion of the volatile gases or other matters passing over the perforated plates of the said air-boxes, may be blown in jets against the bottom of the boiler, as described—the said mode of arranging the air-boxes consisting in giving each of them an inclined position, substantially as represented in the drawings and above described.—[*Inrolled June,* 1848.]

To JAMES CASTLEY, *of Harpenden, in the county of Hertford, manufacturing chemist, for improvements in the manufacture of varnishes from resinous substances.*—[Sealed 11th January, 1849.]

THE first part of this invention consists in manufacturing a strongly adhesive and perfectly water-repellent varnish from resin spirit and gutta-percha.

Three parts, by weight, of the gutta-percha of commerce are put into a pot with nine parts of crude resin spirit (obtained by the destructive distillation of common resin), and subjected to a heat of from 120° to 140° Fahr.,—the mixture being stirred occasionally, until the gutta-percha is dissolved. The varnish, thus produced, is suitable for coating coarse fabrics, such as tarpaulings, rick-cloths, &c.; but, to obtain a varnish suitable for fine articles, the patentee substitutes for the crude resin spirit, above mentioned, a rectified resin spirit, obtained by passing a current of steam through the crude resin spirit, until the condensed product, which comes over, attains a specific gravity of about 0·870; at which point the process of distillation must be stopped, as all products of a higher specific gravity will be injurious to the quality of the spirit.

The second part of this invention consists in manufacturing a colorless varnish from resin spirit and gum damar, or from resin spirit and gum mastic.

The patentee mixes resin spirit, which has been rectified by steam in the manner above described, with from one-tenth to one-sixth of its weight of sulphuric acid, of not less than 1·700 sp. gr., and thoroughly agitates the mixture; then he rectifies the spirit again by a current of steam, when the spirit comes over in a colorless state; after which, he dissolves the gum damar or gum mastic in about four times its weight of this purified rectified spirit, with the aid of a gentle heat. An inferior varnish may be obtained by using resin spirit which has undergone only one process of rectification and has not been treated with sulphuric acid.

The patentee states that, although he has given what he considers to be the best proportions in which gutta-percha, gum damar, and gum mastic, may be combined with resin spirit, yet he does not confine himself to any precise proportions; because varnishes may be formed by combining these substances with any portion of spirit in which they are respectively soluble. He makes no claim to either of the processes of rectification and purification of the resin spirit above described. But he claims, Firstly,—the manufacture of the new varnish compounded of gutta-percha and resin spirit (crude, rectified, or purified), as above described. Secondly,—the manufacture of the new varnishes compounded of gum damar and resin spirit, or of gum mastic and resin spirit, whether such spirit is rectified and decolorized, or rectified only.—[*Inrolled July,* 1849.]

To CHARLES LOW, *of Roseberry-place, Dalston, in the county of Middlesex, Gent., for improvements in smelting copper ore.*—[Sealed 28th December, 1848.]

THIS invention consists in the introduction of atmospheric air into the furnaces used for smelting copper ore, in such manner that currents of air may be introduced above the melted metal and yet below the flame and heated products at the upper part of the furnace.

In the ordinary furnaces openings are left at the top for the purpose of occasionally admitting air, and there are other openings for charging the furnace. Now, this invention consists in constructing furnaces for smelting copper ore with apertures so situated as to allow currents of air to pass over the surface of the melted metal and under the flame or heated products at the upper part of the furnace; and which air, so admitted in currents, becoming decomposed and parting with its oxygen, assists in the separation of the metal from the ore. For this purpose, the patentee constructs the furnaces, when of the reverberatory kind, with several apertures or orifices in the bridge and at other parts of the furnace near the bridge.—[*Inrolled June,* 1849.]

To CHARLES HENRY PARIS, *of Paris, in the Republic of France, manufacturer, for improvements in preventing the oxidation of iron,—being a communication.*—[Sealed 23rd January, 1849.]

THIS invention consists in certain means of coating articles made of wrought-iron with glass or vitreous matter, in order to protect the same from the action of the atmosphere and other fluids and matters which would cause the iron to oxidize.

The articles made of sheet or wrought-iron, whether in the form of vessels, trays, pipes, or otherwise, are first cleansed (which is preferred to be effected by the use of dilute acid) and dried; after which, a coating of gum-arabic, dissolved in water, is applied with a brush to the surface of the articles; and then, the glass or vitreous matter, which has been reduced to a finely pulverized state, is sifted over the surface. The articles are now introduced into an oven or retort, heated to from 212° to 300° Fahr.; when dry, they are removed into another retort, and kept heated to a bright red heat, until the glass or vitreous matter melts on the surface (which may be ascertained by looking through a hole in the cover of the retort or oven); and then the articles are removed into a closed chamber, or covered with a suitable cover, to exclude the air, until they have become cool. If the coating, thus obtained, is found to be imperfect, a second coating of glass or vitreous matter may be applied in the same manner as the first.

The glass or vitreous mixture preferred by the patentee is composed of 180 parts of powdered flint glass, 20½ parts of carbonate of soda, and 12 parts of boracic acid, which are melted together in a glass-maker's crucible; the mixture is removed from the crucible, and, when cool, is reduced to fine powder, which is passed through a sieve having about sixty meshes to the inch; and it is then ready to be used in the manner above mentioned. The patentee says it is important that the glass or vitreous mixture should be free from foreign matter: for this reason he employs hardened steel stampers for crushing the vitreous matter into powder; and, before employing the crucible, he coats the inner surface thereof with glass, by applying gum-water, dusting on the powdered glass, drying the same, and then gradually applying the heat which fuses the glass.

If it be desired that the surface of the iron should have colored glass or vitreous matter applied thereto, the patentee first coats it with the glass or vitreous matter above described, and then he applies a coating of colored glass to the whole or part of the surface, as may be desired.

The patentee states that he does not confine himself to the details above given, so long as articles of iron are coated with a glass or vitreous matter by the means above described. He claims the cleansing of the iron, and applying dry products of glass on to the adhesive matter on the surface of the iron, and then drying and firing the glass, as above described; also the application of carbonate of soda when applying glass to the surface of wrought iron.—[*Inrolled July*, 1849.]

To William Betts, *of No. 7, Smithfield Bars, in the City of London, distiller, for a new manufacture of capsules, and of a material to be employed therein and for other purposes.*—[Sealed 13th January, 1849.]

The capsules referred to in the title of this specification are those metal covers which are applied over the mouths of bottles, jars, and other vessels, and which have been heretofore made of tin. The improvement in the manufacture of capsules consists in forming them of a new material (applicable to other purposes), made by combining lead with tin, by covering the lead with the tin on one or both surfaces and reducing the two metals in their compound state into sheets or leaves of the desired thickness.

The patentee casts the lead into ingots from 4 to 5 inches wide, $\frac{3}{4}$ of an inch thick, and 30 inches long, with a few inches at one end of each ingot gradually reduced in thickness in the manner of a wedge; and he casts the tin either into ingots of the same dimensions as the lead ingots, or into long strips, of nearly the same width as the lead ingots, between $\frac{1}{4}$ and $\frac{1}{16}$th of an inch thick and several feet in length. The lead ingots are reduced by flatting rollers to $\frac{1}{4}$ of an inch in thickness; and the tin ingots are reduced by the same means to $\frac{1}{20}$th of the thickness of the lead. Now, in case it is intended to cover both sides of the lead with tin, a long strip of the tin is laid on a smooth table; a shorter strip of the lead is laid evenly upon the extended tin, with one end of the strip of lead conforming with one end of the strip of tin; the tin is folded back over the other end of the lead (being that end which still retains somewhat of the wedge form), so as to apply itself to both surfaces of the latter; then the strip of folded tin is cut off, to correspond with the length of the strip of lead; after which the tin is rubbed with a wooden rubber, to take out all the wrinkles and bring it very evenly into superficial contact with the lead and with the edges of the tin corresponding with the edges of the lead. The lead and tin are now combined together, by being passed between a pair of flatting rollers (the folded end of the tin being first introduced between the rollers); and the combined metal is reduced to the required thickness for making capsules or other articles by the action of other pairs of flatting rollers, placed closer together.

When the combined metal is to be reduced into thin leaves or foil, the patentee takes a long strip of it and folds it several times upon itself until he obtains a packet consisting of from two to three dozen layers of the length which each sheet of foil is desired to be; and then he passes and re-passes such packet between flatting-rollers, with the lengthway of the packet parallel to the axis of the rollers. The leaves, after having been brought to a very thin state by rolling, may be still further reduced by hammering on a flat table, in the same manner as tin-foil is treated.

The new material, when made into leaves of moderate thinness, may be employed for various purposes, in addition to those for which tin-foil has been commonly used; thin leaves thereof may be embossed with ornamental patterns by passing between a pair of rollers (one being an engraved roller and the other a roller of paper or other substance which will become sufficiently impressed with a counterpart of the pattern by the pressure against the engraved roller); and such leaves may be printed upon with black or colored ink, in the manner of ordinary or ornamental letter-press printing. To preserve the brightness of the thin leaves, the same may be varnished over with any suitable transparent varnish which will resist damp, such as is sometimes applied over gilding, paper-hangings, &c., or varnish colored with light and transparent color may be used. Leaves of the new material, ornamented as aforesaid, may be used in the manner of paper-hangings, for covering the walls of apartments or for ornamenting particular parts of such walls. The new material may also be used for those purposes to which thin sheet-lead, tinned iron, sheet-zinc, and sheet-tin have been hitherto applied.

Instead of the tin covering both sides of the lead, it will be sufficient for many purposes to have the tin on one side only, as when the new material is to be used in place of tin-foil for lining dressing-cases, and for other purposes requiring the leaves to be glued, pasted, or otherwise stuck upon any surface which is to be covered by the leaves.

The patentee claims, Firstly,—the manufacture of the new material, lead combined with tin on one or both of its surfaces, by rolling or other mechanical pressure, as above described. Secondly,—the manufacture of capsules of the new material of lead and tin combined by mechanical pressure, as above described.—[*Inrolled July,* 1849.]

Scientific Notices.

REPORT OF THE COMMITTEE ON THE SIGNET AND PRIVY SEAL OFFICES,

IN RELATION TO PATENT LAW REFORM.

At the early part of the year we stated that a committee had been appointed by government to take into consideration the subject of patents for inventions; we are now enabled to lay before our readers the substance of the Report which has been presented to both houses of parliament. This committee was nominally appointed to inquire into the circumstances connected with the office of the clerks of the Signet and of the Lord Privy Seal; but, as it was found that nearly the whole of the business of these offices consisted in passing patents for invention forward one stage, the question of the utility of this proceeding was naturally raised; and therefrom resulted the examination of parties more or less familiar with, or officially engaged in, the granting of patents for inventions. The whole of the evidence given before the committee is marvellously confirmatory of the badness of the present system of granting patents, and will, we hope, backed as it is by the straightforward Report now before us, have its proper weight with the legislature. We would not, however, have inventors trust too much to this exhibition of sympathy on their behalf; for the cause of patent law reform was, apparently, further advanced in 1833, when Mr. Godson's bill was introduced into the House of Commons; but, owing to the general apathy of inventors, the subject has been allowed to slumber for a further period of sixteen years. It is not the mere exposure of the injustice and inexpediency of retaining the present mode of granting patents, which will ensure the adoption of reformatory measures, but it is the publication of honest appeals to justice and common sense, supported by the earnest co-operation of patentees and inventors, that will be required to carry forward the cause of patent law reform. We have done our part in exposing the abuses of the system; and, in our advocacy of the rights of inventors, have, as many of our friends consider, lost sight of our private interests; we are, however, well content to risk some little for the establishment of a great principle of justice; and we would now call upon inventors generally to do their part. The probability that an alteration in the granting of patents may sweep away the barriers which at present render it necessary for an inventor to secure the services of a qualified agent, before he can procure a patent, is not enough to deter us from prosecuting the great object which we have, for a long series of years, pursued; but it is the apathy of manufacturers, whom the subject of patent protection most intimately concerns, that hangs like a clog upon our exertions. A series of meetings, recently convened by the council of the Society of Arts, for the purpose of aiding the movement of patent reform, has ended for the present (from want of the hearty concurrence of the members) in the imbecile attempt at getting answers to a long string of complex questions, many of which are quite irrelevant to the matter in hand, and could not reasonably be expected to be answered by even the most generous burst of patriotic ardour, if any party could be found equal to the duty: they are very like in character to the queries with which a child will frequently puzzle a theologian, and are a disgrace to the common sense of the council who put them forth. The cause has, however, received some efficient aid from some of the provincial papers, and will, we hope, ere long, be still more prominently brought before the public by means of the press. In the meantime we shall look with some interest for the effect on the government of the Report of the Committee on the Signet and Privy Seal Offices; and if, as is too frequently the case, the Report should produce no speedy results, we trust that inventors will not overlook so important a *point d'appui* for the overthrow of the present costly and inefficient system of granting patents. The Report, so far as it touches upon matters interesting to inventors, proceeds as follows:—

"After considering the evidence, we have come to the conclusion that the number of successive stages through which a patent for a new invention must pass, before its final completion, is productive of great trouble, delay, and expense to the party seeking the grant, without any corresponding benefit to the public.

The fullest opportunity should, no doubt, be afforded to all persons whose interests may be effected by the grant of an exclusive privilege to manufacture some particular article, to shew that good grounds exist why the privilege should not be granted to the party applying for a patent.

The object of granting a patent for an invention is, not merely to secure to an inventor the fair reward of his labour and ingenuity, but also to benefit the public by encouraging such inventions; and it is essential that the Crown should have some tribunal to refer to for advice before making such grants.

With these objects in view, it has not appeared to us that any better course can be devised than a reference to the Attorney or Solicitor-General, to inquire into the merits of the circumstances set forth in the petition, and report thereon to the Crown.

The inquiry would appear, for the most part, to involve considerations rather of a legal than of a scientific nature. But, should questions arise, on an opposed petition, where a more than ordinary familiarity with scientific subjects might seem requisite for the due comprehension of the matter under investigation, the Attorney or Solicitor-General would always have the power, which they now possess and exercise, of calling in some man of practical science, unconnected with the parties before him, and unprejudiced in the matter in dispute, to aid him in coming to a just decision.

We think, however, that ample opportunity having been given for making opposition at this stage of the proceedings, no adequate advantage is derived from a second opposition at the Patent Bill Office. It seems, moreover, that oppositions at that stage are of unfrequent occurrence.

If this opinion should be adopted, and the proceedings at the Patent Bill Office be dispensed with, we would then recommend that some public notice, by advertisement in the *Gazette* or otherwise, should be given—that a patent for aparticular object has been applied for, not naming the applicant, or giving more than a very general description of the object of the invention; and that a sufficient number of days should be allowed from the date of the advertisement before proceeding with the petition, in order that a fair opportunity for opposition may be afforded to parties desirous of opposing the grant sought for.

We would also recommend that an outline description, such as is now required to be deposited with the Attorney or Solicitor-General in cases of opposed patents, should be required to be lodged, under seal, with every petition, on its first presentation at the Home Office. It is not proposed that this outline description or specification should supersede the specification now required to be enrolled in Chancery; nor that it should be required to enter into the details of the invention; but that it should be considered binding as to the principles of it.

With these provisoes, we are of opinion that a patent, when granted, might take its date from the day on which the petition is presented; instead of, as at present, from the day on which the patent is sealed.

We would further suggest for consideration, whether, after the report of the Attorney or Solicitor-General, recommending the grant of the patent, a Queen's Bill, carrying the recommendation into effect, might not be prepared at the Home Office, and submitted by the Secretary of State for Her Majesty's signature. We see no reason why it should be engrossed on parchment; we think, on the contrary, it would be far more convenient if it were prepared after the manner of an ordinary Sign Manual Warrant.

We are of opinion that the Queen's Bill, when duly signed, should be passed at once to the Lord Privy Seal, without the intervention of the Signet Office; that the Privy Seal should be affixed to that instrument upon the authority of an instruction to that effect from the Secretary of State; and that the two transcripts prepared in the Patent Bill Office, which now form the Signet and Privy Seal Bills, should be dispensed with.

We, at the same time, recommend that the public seal days in the Privy Seal Office should be extended to two days in the week.

If the proceedings in the Patent Bill Office and in the Signet Office be entirely dispensed with, the fees now payable at those offices must of course cease to be levied. It becomes, therefore, necessary to revise the charges to which letters patent are liable in passing through their several stages previously to their arrival at the Great Seal.

In the case of patents for inventions, the confining the opposition before the Attorney and Solicitor-General to one stage only, will probably render necessary a more rigid investigation at that stage than is required under the present system, and will throw increased responsibility upon the reports of those officers. We consider that, under these circumstances, the Attorney and Solicitor-General would have a fair claim to a higher fee for the single hearing and report than is allowed to them at present. We recommend, therefore, that one fee of ten guineas should be allowed to the Attorney or Solicitor-General for the hearing and report together (including the fees to their clerks), instead of the separate fees they now receive, amounting to £3. 5*s*. for the hearing, and £4. 4*s*. for the report.

We further recommend that, in lieu of requiring successive payments of fees and stamp duties at the several public offices, a stamp should be affixed to the Queen's Bill in the department in which it is prepared.

In the case of patents of appointment to office, the amount of this stamp might be a small per centage on the salary of the office.

In the case of patents for inventions, we would recommend a stamp of uniform value, without reference to the number of names included in the grant. Should it be determined to extend the power of granting patents under the Great Seal of the United Kingdom to Ireland and Scotland, we are disposed to recommend that, for a patent extending over the United Kingdom, the Channel Islands, and the Colonies, a stamp of fifty pounds should be required.

But, if it should be thought inexpedient to debar inventors from taking out patents for England alone, in that case we recommend that a stamp of thirty pounds should be imposed on patents for England, with the Channel Islands and Colonies; with an addition of twenty pounds for Scotland and Ireland, or of ten pounds for either Scotland or Ireland separately.

We are inclined to believe that such an arrangement would afford satisfaction to patentees, and would, at the same time, compensate the revenue for the loss which it would sustain by the adoption of the course we have recommended.

We do not feel ourselves authorized to make any suggestions in regard to the proceedings before the Lord Chancellor.

We have, however, had our attention called to the subject of the specifications, and their mode of enrolment, which is intended to be for the information of the public.

It is of great importance to a party applying to take out a patent for an invention, to ascertain what patents, in relation to the same object, have been previously taken out; otherwise, after he has incurred considerable expense in perfecting his invention, and obtaining a grant, some previous patent may be discovered which may vitiate his patent by destroying its originality.

For this, and other reasons, it would seem very desirable that specifications should be made more available to the public than they are at present.

It has already been stated that specifications have been hitherto enrolled in three different offices, searches in all of which must frequently be made before a party, seeking to obtain a patent for a new invention, can satisfy himself that no similar patent has at any time previously been granted; and, from the absence of indexes or proper classification, these searches must always be attended with great uncertainty, and often with great expense.

The difficulties of such a search are enhanced by the specifications being copied on rolls in an engrossing hand.

We are of opinion that these specifications should be entered, in a book-form, in a common hand; and that proper indexes should be made of them. They would then become very valuable references for the public.

Another point to which we have had our attention very much directed is the necessity of a patent going through three distinct and separate processes, in order to be made available for the three kingdoms.

By the 24th article of the Act for the union of the two kingdoms of England and Scotland, 5 and 6 Anne, c. 8, it is enacted, 'That a seal in Scotland, after the Union, be always kept and made use of in all things relating to private rights or grants, which have usually passed the Great Seal of Scotland, and which only concerns offices, grants, commissions, and private rights within that kingdom.'

By article 8, sec. 3, of the Act of Union with Ireland, 39 and 40 Geo. III., c. 67, it is enacted, 'That the Great Seal of Ireland may, if His Majesty shall so think fit, after the Union, be used in like manner as before the Union, except where it is otherwise provided by the foregoing articles, within that part of the United Kingdom called Ireland.'

These enactments preclude the Lord Chancellor, though Keeper of the Great Seal of the United Kingdom of Great Britain and Ireland, from granting a patent which can extend to Scotland or Ireland.

An inventor, therefore, in order to secure to himself the full benefit of his invention, must, in many cases, take out a patent under each of the three Great Seals of England, Ireland, and Scotland; thereby, in addition to the increased trouble and delay, very considerably raising the expenses of his patent.

The fees and other charges incurred in taking out a patent for England, the Channel Islands, and the colonies, amount, on an average, to about £150. But, in order to secure a patent for the three kingdoms, a patentee must incur an expenditure of probably three times that amount.

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It appears that previously to the passing of the Acts of Union, patents extending over the three kingdoms were sometimes passed under the Great Seal of England alone; and we see no real practical inconvenience which would arise from permitting such a course to be pursued at the present time.

We would suggest that all patents for new inventions might be granted, as of course, for the United Kingdom of Great Britain and Ireland, and that the proceedings for obtaining a patent should take place in this kingdom only. The specification, in that case, should be required to be enrolled in each of the three capitals.

The proceedings for a patent, whether in England, in Scotland, or in Ireland, must originate by petition to the Crown; and it would seem that Scotch and Irish inventors almost invariably take out patents in England, if not previously to, at all events immediately after, taking out their Scotch or Irish patent. The advantage, therefore, that would arise from the course recommended, in the saving of fees and other charges, and of time and trouble, would be at least as great to the Scotch and Irish patentee as to the English.

Cases, however, may occur in which it might be advisable to have the opinion of the Crown lawyers in Ireland or in Scotland previously to Her Majesty being advised to grant her letters patent.

We would therefore suggest that, if it should be determined to give the power of granting patents under the single Great Seal of the United Kingdom, which would have effect in the three kingdoms equally, a discretionary power should be given to the Secretary of State, enabling him, should he see fit so to do, to refer the petition to either the Attorney or Solicitor-General for England, the Attorney-General for Ireland, or the Lord Advocate of Scotland.

If the views which we have formed with regard to the abolition of patents in some cases,* and the simplification in all of the process of passing them, shall be approved of, the retention of the Signet Office, as a distant branch of the department of the Secretary of State, will become unnecessary.

We therefore recommend that the Signet Office be abolished, and whatever business may remain to be transacted connected with the Signet be transferred to the Home Office, together with such of the records, &c., now deposited in the Signet Office, as may be necessary for the purposes of official reference. The remainder might be consigned to the custody of the Master of the Rolls, or to the State Paper Office.

The amount of business thus transferred to the Home Office could not be very considerable.

It would still be necessary to retain an establishment for the office of the Lord Privy Seal, though the duties of that office would be much reduced, and would not occupy the time of more than one clerk.

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* This does not refer to Patents for Inventions. [Ed. Lond. Jour.]

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We think it desirable to refer to the Act of 1 Vic., c. 73, by which the Queen is enabled to confer certain powers and immunities on trading or other Companies by means of letters patent.

The operation of that Act will not be in way affected by the changes proposed in this Report, which have reference only to the mode of passing letters patent.

In concluding our Report, we beg leave to express a hope that the interests of individuals who may be affected by our recommendations and suggestions may be duly considered, and that compensation may be awarded to those whose tenure of office gives them a title to claim it."

MINTO.
G. CORNEWALL LEWIS.
H. RICH.

NEW METHOD OF LAYING DOWN RAILS ON RAILWAYS.

BY M. W. B. ADAM.

[Translated for the London Journal of Arts and Sciences.]

THE gradual increase which has been made in the weight of locomotive engines ever since their introduction, has, from the proportionate increase of wear and tear of the rails, as at present laid down, suggested the idea of modifying, to a great extent, their construction. Of the many plans which have been proposed for that purpose, the one described in the present paper seems particularly to merit the attention of companies and engineers.

The simple friction of the axles of railway-carriages, or the effort necessary for moving them from one line to another, does not exceed 4 lbs. per ton; but, in practice, it is found to amount to from 8 to 24, and even to 30 lbs.; so that there is a loss of from 4 to 26 lbs., which must be attributed to the friction between the wheels and the rails; and to this must be added that of the *vis viva*, resulting from the defective arrangement of the points of junction of the rails (from their flexion and other general defects of construction), without taking into account the great speed at which these heavy bodies travel; in consequence of which, when a railway has once received injury, it increases, in geometrical proportion, by reason of the jumps which the wheels make in passing over inequalities. In all railways, constructed with the ordinary sleepers, there is great loss of power arising from the unequal resistance of the various parts. Practical experiments have shewn that the flexion of a rail, under a given weight, is four times greater over the cross-sleepers than over the longitudinal sleepers,—which tends greatly to increase the jumping movement, as it is impossible for a vehicle to run well horizontally upon a line, the elasticity of which is continually varying. A comparatively slight rail, with well-constructed joints, is much preferable to a heavier rail, the joints of which are badly adjusted and slight: for this reason the light rail of Brunel's broad gauge, which is laid down on longitudinal wooden sleepers is, and always will be, mechanically speaking, preferable to the blocks and cross-sleepers of the narrow gauge.

A defective arrangement of the foundations of railways has also great influence upon their deterioration. The sleepers are perhaps not sufficiently close together, or they are not sufficiently broad, which renders them liable to sink into the ballast, and necessitates the frequent taking up of the rails. Add to this the quick decay of the wooden sleepers (no efficacious remedy for which has yet been discovered) and we have the whole of the objections which may be raised against the system in use. No surprise can, therefore, be felt that Stephenson, who was perfectly acquainted with the extent of the evil, should have declared, before the House of Commons, "that if the weight and speed of the vehicles continued to be increased, it would be necessary to take up all the lines of railway, and lay down fresh ones."

There are two methods of lessening or entirely obviating the evils in question, viz., the adoption of lighter engines, or another mode of laying down the rails. Reasoning on the principle of the broad gauge, it is certain that a large locomotive is more advantageous than a small one, provided it has always a full load, or an amount of work to perform equal to its power. It would appear, therefore, that the former would better answer the desired end, in a commercial point of view, provided its weight and speed did not exceed what Stephenson calls—the economic charge, which the way is capable of supporting. As, however, it is not always possible to provide the large locomotives with an amount of work equal to their power, this proposition requires to be modified; and light engines may often be found advantageous for traffic, whilst their deteriorating influence upon the way evidently amounts to next to nothing compared to that of the first class. As regards the advantage, in a commercial point of view, the speed of the engine may be increased in direct proportion to its lightness,—reserving engines of great weight exclusively for luggage and other trains not requiring to travel at great speed. The arguments in favor of light engines are, however, well known,—we will therefore proceed to a consideration of the improvements in the permanent way.

In the construction of those lines in which detached sleepers or blocks are used, they require to be long and heavy, in order to resist the effects of the leverage of the rails, which tend to tear them from the sleepers when the wheels strike laterally. No alteration in the blocks, except a great increase in their dimensions, can obviate the very injurious wear between the rail and its *point d'appui* in the block. The only means of remedying this evil is by doing away with the blocks. In Plate III., a method of effecting this is shewn; the cost of which very little exceeds that of the ordinary plan of supporting the rails.

Fig. 1, represents, in transverse section, a rail, mounted in continuous longitudinal supports; each of these supports is composed of two longitudinal sleepers, about $0^{m}\cdot175$ square, bolted together, and having on their inner or contact sides a recess to receive an enlargement at the bottom of the feather on the lower part of the rail; the section of which presents the form of a cross. The bolts which fasten these two supports together pass through the feather; thereby holding it firmly between the supports. The upper part of the rail, which lays on the supports, is furnished with horizontal wings, which ensure its stability; and this is further increased by the feather being tightly held between the blocks, and by the formation of the lower part of the said feather. In order to prevent as much as possible any play of the bolts, which action is found to take place to an injurious extent in the ordinary plan, the faces of the blocks, upon which the rails bear, are coated with pitch, so that all the points of contact between the wood and the iron are perfectly protected from wet and rust.

Fig. 2, is a section through that part of the line where two sections of rail are joined. In this figure will be seen the joining pieces employed for giving greater stability to that part of the line; these pieces consist of plates of wrought-iron, about $0^{m}\cdot250$ long, beaten at top into a T-shape, so as to present a vertical surface of $0^{m}\cdot038$, which is fixed to the wood,—the remainder forming a horizontal seat for the rails. These pieces of iron are of such thickness as to be flush with the foot of the feather. A bolt, about an inch thick, passes right though the middle of these joining pieces, and also through the point of junction of two sections of rail. The proposed dimensions of the rails are as follows:—Breadth of the face for the wheel to run upon $0^{m}\cdot062$; breadth of the lugs, serving as supports upon the wood, $0^{m}\cdot151$; thickness of the feather $0^{m}\cdot156$; height of the face of the rail above the sleepers $0^{m}\cdot052$; face of the wood at the lowest part of the feather $0^{m}\cdot115$. The two lines of rail are connected together by transverse wooden sleepers, fixed to the longitudinal sleepers at distances of five yards. The joints of the longitudinal sleepers and of the rails alternate, so as to equalize as much as possible the power of resistance.

In place of the above method of joining, it might be effected by a system of reciprocal support for the extremities of the rails, by introducing a portion of the feather in the next one. For each five yards, a transverse sleeper, a joining piece, and ten bolts are employed.

Another modification of the system of longitudinal support is represented at fig. 3. In this arrangement the section of the rail differs from the preceding one; it is a T reversed, the cross part of which, serving as the support, is $0^{m}\cdot112$ in breadth. In this case, suppose the pieces of timber used to be $0^{m}\cdot200$ square, arranged in pairs, end to end, and having each a deep slot to receive the sides of the T-piece, the total height of the rail is only $0^{m}\cdot100$; the joining-pieces, indicated by the dotted lines at A, A, are $0^{m}\cdot300$ in length, and $0^{m}\cdot025$ in thickness, to compensate for their want of height. The intermediate bolts, which serve to connect the pieces of wood, pass through the centre of the longitudinal sleepers; but, at each joint, there is besides a bolt which traverses the joining-pieces of the rails, as shewn by the dotted lines in fig. 3.

The essential character of this invention is, that it presents throughout a uniform degree of solidity. When once it is laid down upon a firm soil there will be little to fear as regards its stability; and it is presumed that the expenses of keeping it in order would be very trifling. There are no pins or bolts requiring continual inspection,—no chairs which are constantly liable to become loose and break, as is the case in the ordinary method. But, as the question of practicability resolves itself at last into a matter of pounds, shillings, and pence, the following tables are given, which draw a comparison between the improved plan and that generally in use in England,—both being presumed to be subjected to the same casualties as regards traffic and position:—

Expenses of old plan for a length of 5 *metres.*

	fr.	cent.
2 rails, 5 metres in length, weighing 40 kilogr. per metre,—in all 400 kilogr., at 18 fr. 50 per 100 kilogr.	74	0
2 joining-blocks or chairs, weighing 25 kilogr. each, at 10 fr. 60 per 100 kilogr.	5	30
8 intermediate chairs or blocks, weighing 13 kilogr. 60,—in all 108 kilogr. 80, at 10 fr. 60 per 100 kilogr.	11	55
5 wooden sleepers, at 6 fr. 60	33	0
20 bolts or trenails	2	60
10 keys	1	20
	127	65

Expenses of 5 *metres, according to new plan.*

	fr.	cent.
2 longitudinal sleepers, 5 met. long $(0^{m}\cdot175 \times 0^{m}\cdot175) = 0^{met.\ cub.}\cdot300$ at 170 fr. per cubic metre	51	0
1 sleeper of $1^{m}\cdot20$ $(0^{m}\cdot175 \times 0^{m}\cdot175) = 0^{met.\ cub.}\cdot0367$, at 170 fr. per cubic metre	6	25
2 rails, of 45 kilogr.,—in all 450 kilogr., at 18 fr. 50	83	25
4 joining-pieces, weighing together 4 kilogr. 50	3	20
1 bolt, for joint, weighing 5 kilogr.	1	75
8 bolts, weighing together 13 kilogr.	4	80
	150	25

There are few engineers prepared to dispute the fact, that the finest line of railway now in existence is the English one called the Great Western Railway. In constructing this line, Mr. Brunel endeavoured to produce the most perfect way possible without regard to expense; and he has been, in a great measure, successful. There are, however, two objections to his method of construction; one is the difficulty of keeping the rails tight in their places; and the other is the lightness of the rails employed. Now, the plan above described possesses all the advantages of Mr. Brunel's plan, without requiring its enormous outlay.

Up to the present time the preservation from rapid and premature destruction of the wood used in the construction of railways has not perhaps sufficiently attracted the attention of the different companies; but it is to be hoped that they will soon be led to appreciate the considerable annual losses which result from this cause, and that they will seek to apply some preservative means, as the destruction of a piece of wood, exposed half to the earth and half to the air, is found to be prodigiously rapid:—this is the weak point of the plan proposed at present; which, however, it labors under in common with the other plans.

The plan above set forth is not a mere theoretical speculation, for it has been tried on a small scale on a short working line. By the above comparison of the first expenses of laying down the rails between the old and proposed plans, it will be seen that, although the latter certainly shews an excess, it is very trifling; whilst the chances of its retaining its good working condition would appear to be at least doubled.—[*Technologiste.*]

PROCESS FOR EXTRACTING GOLD FROM SOLUTIONS OF AURO-POTASSIO CYANIDE, WHICH HAVE SERVED FOR GILDING.

This process is only applicable to auriferous liquids, prepared by means of potassio cyanide. They are to be evaporated to dryness, and the residuum pulverized, and mixed with an equal proportion of litharge. This mixture is introduced into a Hessian crucible, and heated to a bright red. By this operation, a portion of the plumbic oxide is reduced to the state of metallic lead, which takes up the gold, and forms with it a fusible and very heavy alloy, which is deposited at the bottom of the crucible. When cold, the crucible is to be broken, and the metal at the bottom removed, and treated with hot dilute nitric acid. All the lead is dissolved in the state of plumbic nitrate; and the pure gold remains in the form of a brownish yellow spungy matter.—[*Ibid.*]

ON THE MANUFACTURE OF AMBER VARNISH.

BY M. STELLING.

In manufacturing amber varnish according to M. Stelling's method, the amber (which has to be submitted to high temperature to melt it) is introduced into a stout copper vessel, which is closed at top and luted with clay. This vessel is furnished at its lower end with a funnel-shaped vent, which carries a perforated sheet of iron or sieve, sufficiently fine to prevent the escape with the melted amber of any impurities which might be contained in the amber. This vessel is introduced into a large chafing-dish fixed upon a high stand, and its tapering bottom projects through a hole in the bottom of the chafing-dish and extends a few inches downwards. When the vessel is thus adjusted, the chafing-dish is nearly filled with coal and lighted. The fuel is, by the peculiar form of the chafing-dish, prevented from dropping into the oil vessel, to be presently described, and thereby soiling the liquid.

The heat from the ignited fuel very soon heats the vessel to such a temperature as will melt the amber and cause it to flow through the perforated metal or sieve above mentioned; in passing through which it will be purified from all extraneous matters. The melted amber runs into a copper vessel which is placed below the chafing-dish, and is provided with a long handle. This vessel or receiver is filled about two-thirds full with the oil from which it is intended to prepare the varnish, and is placed upon an ordinary chafing-dish charged with incandescent fuel, which heats the amber to such a temperature as to cause it to become incorporated with the oil. When this is completely effected, the vessel is cleansed for a fresh operation, and the other ingredients necessary for the manufacture of the varnish are added to the mixture of oil and amber, as soon as it has cooled down to a suitable temperature.

These very simple means present the following important advantages over those now in use for the manufacture of varnishes:—

1st. The amber melts completely without any residuum; and as it is contained in a perfectly tight vessel, nothing, or next to nothing, is lost by the evaporation of its constituent parts.

2d. The application of a high temperature effects the fusion with ease and rapidity.

3d. This mode of preparing varnishes is perfectly free from danger, as regards fire. The amber is contained in a perfectly close vessel, and cannot, therefore, take fire, especially as the air has no access through the spout through which the melted amber flows. Neither will the oil into which the melted amber flows be liable to take fire, for it does not require to be heated to a very high temperature, as is at present the practice,—the amber being now melted and dissolved in oil heated to the point of violent ebullition; and further, the chafing-dish is small, and it is impossible it can communicate to the vessel filled with oil (which is of much more considerable capacity) sufficient heat to cause fear of fire.

4th. All the vessels are of stout copper, and consequently are not liable to burst, as is the case with the earthern ones, which are at present too often employed.

It will thus be seen that, independently of the practical advantages which this method of manufacturing varnish (and which has already stood the test of long experience) possesses over those ordinarily in use, it has the important one of being unattended with danger.—[*Ibid.*]

EMPLOYMENT OF ELECTRICITY FOR ORNAMENTING PORCELAIN AND EARTHENWARE.

BY M. R. S. BLACKFORD.

THIS invention has for its object the decoration of porcelain and pottery, by means of various agents, so as to produce various shades or colors. When the design is required to be purple, for instance, the porcelain article, after being warmed, is placed in water for a few seconds, and afterwards in a solution of muriate of tin. The next operation, supposing the article to be a cup, consists in removing it from the solution, and arranging it in such manner that its upper part inside shall be in contact with a rod of lead, in communication with the cathode or negative pole of a voltaic battery: a chain is attached at one end to the anode or positive pole of the battery, and at the other to a piece of gold wire. The gold wire is applied to the outer surface of the cup, opposite the leaden electrode, and held in the same manner as a pen or pencil. When the wire comes in contact with the article to be decorated, it will make a purple mark; so that, by this means, any design may be produced by turning the cup on the electrode of the cathode. In this operation a small portion of the gold wire is dissolved, and combines with a certain quantity of the tin contained in the solution,—thereby forming purple of Cassius. When the design is completed, the article upon which it has been produced is to be immersed in water, and then passed through the glaze or enamel, after which it is placed in the oven or kiln.

According to another method, which is much more simple, the design or pattern, a bunch of flowers for instance, is cut out in leaf gold, and mounted on a band of gutta-percha. After immersion in a solution of tin, the cup is placed upon the electrode of the cathode, in the manner described in the first process; the chain proceeding from the electrode of the anode is attached to the gold pattern; whilst the band of gutta-percha is laid round the cup so as to bring the gold pattern in intimate contact with the surface. The cup is then turned in such manner that the leaden electrode passes successively over the interior surface of the cup, opposite to the design, and a colored impression of the pattern is produced on the surface of the porcelain, corresponding to the design cut out of the gold leaf. Enamelling or glazing will now complete the operation.

In the above succinct description, the ornamenting of a cup has been instanced to simplify the explanation of the operation; it should, however, be observed, that the process is applicable to articles of any form or dimensions. If it be required, for instance, to decorate the interior of a saucer, a pattern is to be cut out in leaf gold, and the gutta-percha is of such form as to correspond with the surface to be operated upon, and the electrode of the cathode is brought into contact with the interior surface.

If various colors or patterns are required to be produced, the gutta-percha band must be provided with several kinds of metals, such as gold, platinum, palladium, silver, copper, iron, or cobalt; and the articles are to be immersed in chloro-nitric acid, and in a solution of ferrocyanide of potassium instead of muriate of tin.

Metallic lustre is produced by covering the gutta-percha bands or moulds, which are adapted to the articles to be ornamented, with sheets of gold, platinum, copper, or iron. The articles are to be washed in chloro-nitric acid, and the moulds, after having been adjusted, are submitted for a short time to the action of the electric current. When these moulds have been removed, the articles are to be kept wetted with chloro-nitric acid for some minutes, in order to dissolve the oxides which have been formed on their surface. They then present an aspect similar to that produced by a layer of a solution of the metal in *aqua regia*, and may then be enamelled or glazed. By the employment of electricity for this purpose, it is supposed that great economy will be effected, as the preparation of salts and oxides will be thereby dispensed with, and also the use of presses, paper, and glazing. The particles of the oxides deposited by the electric process are so fine and close that they produce the desired effect, while causing scarcely any perceptible diminution in the weight and volume of the metals, which will last for a considerable length of time without requiring renewal.

The experiments, from which these facts were elicited, were made with an ordinary voltaic battery of 32 pairs of plates of 75 millimetres (about 2½ inches); for operations on a large scale, however, a constant battery of 64 pairs of 10 centimetres (about 3½ inches) would be required.—[*Ibid.*]

ON THE PREPARATION OF VITRIFIABLE COLORS IN PAINTING ON PORCELAIN.

BY M. A. WACHTER.

The art of painting in vitrifiable colors has not received all the development of which it is evidently susceptible, but has been suffered to lag behind in the march of science. It still presents to the artist too many practical difficulties to offer an advantageous field for his efforts; and for this reason his productions have not attained that importance in the arts which the durability and lightness of his colors would seem to warrant. The cause of the inferiority of this branch of the arts appears to arise from the fact that the certain preparation of good vitrifiable colors is still, notwithstanding the numerous recipes which have been published, a secret known only to a few. The communications on this subject, which are found in periodicals and other works, are too incomplete and vague to furnish sufficient information. Even in that otherwise estimable work of M. Brongniart, intituled *Traité des Arts Céramiques*, the chapter upon the preparation of colors is very unsatisfactory, and only contains some scanty documents, prepared (although with great reserve) from experience acquired at the manufactory at Sèvres. It becomes, therefore, a matter of great interest, both in an artistic and scientific point of view, to endeavor to develop the art of painting in vitrifiable colors; but so long as those who are desirous of studying this subject are compelled (as M. Wachter states was the case with him) to acquire for themselves that experience which others have already attained, but kept their knowledge a secret, they will, after all their trouble, arrive at no more certain results than their predecessors. It is the cognizance of this fact which deters chemists and others, who might make some valuable discoveries, from giving their attention to the subject, and drives them to other more profitable and less uncertain researches.

The branch of painting in vitrifiable colors, best known and most cultivated, is the art of painting on porcelain. The hard enamel of porcelain is, from its difficulty of fusion, less injurious to the more easily fusible colors than painting upon glass, earthenware, and other kinds of enamel. The colors for painting upon porcelain are all, after firing, glasses of lead colored throughout, and most of them a mixture of a colorless glass of lead or flux and of coloring matter. In what are called gold colors, such as purple, violet, and pink, the coloring body is a preparation of gold, the manufacture of which has been considered, up to the present time, as presenting peculiar difficulties, by reason of which it is always rendered uncertain. The following are the processes employed by M. Wachter for the preparation of these colors:—

PURPLE COLORS.

Light purple.—5 grammes of tin turnings are dissolved in boiling *aqua regia*; the solution is concentrated in a water bath until it solidifies in cooling. The chloride of tin, thus obtained, and which still retains a slight excess of hydrochloric acid, is dissolved in a small quantity of distilled water, and mixed with 2 gr. of a solution of chloride of tin of sp. gr. 1·700, and which had been prepared by boiling shreds of tin in an excess of hydrochloric acid, until it attained the degree of concentration indicated. This mixture of solutions of tin is poured into a large glass vessel, and diluted with 10 quarts of distilled water. It must then contain sufficient acid to allow oxide of tin to be precipitated without clouding the liquid. This may be previously ascertained by taking up, with an earthen rod, a drop of the concentrated mixed solution, and diluting it with distilled water in a watch-glass. Into this solution of tin, diluted with 10 quarts of water, is poured a solution (as neutral as possible) of 0·5 gr. of gold in *aqua regia*, stirring continually. This solution must previously have been evaporated nearly to dryness in a water-bath, then diluted with water, and filtered in a dark place. After the addition of the solution of gold, all the liquor assumes a deep red tint, without however any precipitate being formed, as this only takes place when 50 gr. of liquid ammonia are added. If deposition did not then take place (which might happen if the ammonia were in great excess) the liquor would present a deep red appearance; but the precipitate would shew itself immediately on the addition of a few drops of concentrated sulphuric acid. This precipitate is very speedily formed at the bottom of the vessel; and the supernatant liquor must be decanted off as soon as possible, and replaced five or six successive times by an equal quantity of pure water. Having been thus sufficiently washed, the precipitate is to be collected upon a filter, and, after letting the excess of water drain off, it is taken off, while yet damp, with a silver spoon, and mixed intimately upon a glass plate, by means of a spatula and mullet, with 20 gr. of glass of lead or flux, previously ground very fine with water. This glass of lead or flux is prepared by melting together 2 parts of minium, 1 part quartzose sand, and 1 part calcined borax.

The mixture of gold purple and glass of lead, after being intimately combined, as above described, is carried on the glass plate into a moderately warm room, and exposed as little as possible to dust; it is there slowly dried, and, when dried, finely ground up with 3 gr. of carbonate of silver. By this means, with 0·5 gr. of gold, 33 gr. of light purple are obtained.

The proportions above mentioned between the glass of lead, carbonate of silver, and precipitate of gold, are only suitable for a certain degree of temperature, at which the color is to be burnt upon the porcelain, which approaches as nearly as possible the point of fusion of silver. If the burning is to take place at a lower temperature, it is necessary that the proportion of glass of lead to the gold should be more considerable; and, on the other hand, that of the carbonate of silver should be less. The same observation holds good in the preparation of purple for painting upon glass.

The finest purple may be completely spoilt on firing in the muffle. If the firing takes place at too low a temperature, the colors remain brown and dull; if, on the contrary, the desired degree be exceeded, it will be pale and bluish. Vapors suited to produce reductions,—and particularly acid vapors, vapors of oxide of bismuth, &c., also have an injurious effect upon it.

Dark purple.—A solution, clear, and as neutral as possible, of 0·5 gr. of gold, in *aqua regia*, is to be diluted in a large glass vessel with 10 quarts of distilled water, to which are to be added 7·5 gr. of prepared chloride of tin, of sp. gr. 1·700, as above mentioned, stirring continually. The liquor assumes a deep brownish red; but the precipitate is not formed until some drops of concentrated sulphuric acid are added. The supernatant liquor is decanted off, and replaced by the same quantity of pure water six times in succession. When thus washed, the precipitate is collected on a filter; and, after the superfluous water has drained therefrom, it is removed, while damp, with a spatula, and afterwards intimately mixed in the same manner as for the former color, upon a glass plate, with 10 gr. of glass of lead, as above mentioned. It is then dried in the same manner as for light purple, and, when dry, mixed with 0·5 gr. of carbonate of silver, and ground fine. By this means, about 13 gr. of deep purple are obtained. The proportions of carbonate of silver and gold given are those which are found to be suitable for firing at the same degree of heat as above mentioned for light purple;—for lower degrees of heat, the quantity of glass of lead or flux must, as for painting on glass, be augmented; while the proportion of salt of silver must be less.

VIOLET COLORS.

Red Violet.—The precipitate of 0·5 gr. of gold is prepared in the same manner as for dark purple, and collected on a filter; while damp, it is ground up on a glass plate with 12 gr. of a glass of lead, which is prepared by melting together 4 parts of minium, 2 parts of quartzose sand, and 1 part calcined borax. It is then dried as before, and again ground upon glass, no silver being however added. The proportions of glass of lead and gold are only suitable for the same degree of heat employed for the purples; if a greater degree of heat be employed for firing in the muffle, a larger proportion of glass of lead must be used. On adding a small quantity of silver, this color is changed into dark purple. When employed for painting upon glass, it furnishes alone, a fine purple.

Blue violet.—The precipitate of gold, after being prepared in the same manner and the same proportions as for dark purple, or red violet, is, while damp, ground on glass with 10·5 gr. of glass of lead, obtained by melting together 4 parts of minium and 1 part quartzose sand: the mixture is then dried slowly, as for the other colors, and ground on glass a second time. If a less heat be employed in the muffle, a larger proportion of glass of lead must be added.

This blue violet is particularly applicable for mixing with blue colors, to which it gives a better tone than can be obtained from the red violet. It cannot be used for painting upon glass. The conditions requisite for producing fine vitrifiable blues and purples are, fine grinding, and perfect mixture, first, of the gold in the precipitate of gold, and of the precipitate of gold in the flux. This is effected by mixing and melting the precipitate while damp.

By mixing the light with the dark purple, or with the red violet, or this latter with dark purple, in requisite proportions, any desired shades of purple or violet may be produced. The light purple, prepared without the addition of silver, furnishes an amaranth red, similar to that observed upon old porcelain of the last century, when it does not appear that the peculiar property possessed by silver of changing amaranth red into a lively red was known. Dr. Richter, however, who, at the commencement of that century, prepared the colors at the royal manufactory at Berlin appears to have made use of it as his purple; for many articles painted at that time possess a very fine lively tint.

RED.

Pink.—Dissolve 1 gr. of gold in *aqua regia,* mix the solution with a solution of 50 gr. of alum in 20 quarts of spring water, and add, stirring all the while, 1·5 gr. of a solution of chloride of tin of sp. gr. 1·700; then pour in a sufficient quantity of liquid ammonia to precipitate all the alumina. After the precipitate has been allowed to settle, the supernatant liquor is decanted off and the precipitate well washed with ten times the quantity of pure water; it is then thrown on a filter and dried at a gentle heat. This precipitate weighs about 13·5 gr., and is, for the preparation of the vitrifiable color, mixed intimately with 2·5 gr. of carbonate of silver and 70 gr. of flux or glass of lead, the composition of which (2 minium, 1 quartzose sand, 1 calcined borax) was given for light purple; it is then ground fine upon glass. This color is only fit for the preparation of light pink grounds upon porcelain, and can only be laid on in very thin layers; if laid on thick, metallic gold will be disengaged, and the color will be totally destroyed.

None of the colors prepared from gold, as above described, furnish, as one would be led to believe, glass of a red or violet color; but, on the contrary, produce dirty yellowish, or brown colors; which, in consequence of the revivification of the gold and silver, acquire a liver-like tint. The fine tones which belong to them will only develop themselves when applied in very thin layers, when they are melted upon the enamel of the porcelain; which they color throughout, as will be seen on breaking a piece of porcelain painted in this manner. If the layer exceeds a certain thickness, regulus of gold and silver are disengaged, and thus cause the tints to assume a liver-like tint, as is the case with purple and violet; or they become colorless like the fusible pink.

YELLOW COLORS.

The yellow colors for painting on porcelain are glasses of lead, colored either by antimoniac acid, or by oxide of uranium. The antimoniate of potash necessary for this purpose is prepared by causing 1 part of metallic antimony, finely pulverized, with 2 parts of saltpetre, to detonate in a Hessian crucible,—the residuum being washed with water. With regard to the oxide of uranium, it is obtained in the most suitable form by heating nitrate of uranium until the nitric acid is completely driven off.

Lemon color.—8 parts of antimoniate of potash, 2·5 of oxide f zinc, 36 of glass of lead or flux (which is prepared by melting gether 5 parts of minium, 2 of white sand, and 1 of calcined borax) are intimately mixed and heated in a porcelain crucible, introduced into a Hessian crucible, until the matter it contains has passed into a state of semi-fusion, or attained the consistency of paste; it is then taken out with a spatula, and, on cooling, is broken and finely ground with a muller on glass. If the color be kept in a state of fusion for a longer period than is required for perfect union of the substances, the yellow would be converted into a dirty grey, by reason of the destruction of the antimoniate of lead.

Light yellow.—4 parts of antimoniate of potash, 1 of oxide of zinc, 36 of glass of lead (prepared by melting together 8 parts of minium and 1 part of white sand) are mixed carefully together, and melted in a Hessian crucible, broken and ground fine after cooling. A prolonged state of fusion has, in the preparation of this color, a less injurious effect than in the former instance, by reason of the absence of borate of soda in the formula of the flux. The color itself is a more intense yellow than the preceding, and mixes readily with reds and browns; but, when mixed with green colors, it furnishes less purity of tone than the former: by reason of its superior weight, it flows better from the brush than this latter, and may, without risk of cracking on firing, be laid on thicker.

Deep yellow, No. 1.—48 parts of minium, 16 of sand, 8 of calcined borax, 16 of antimoniate of potash, 4 of oxide of zinc, 5 of oxide of iron (*caput mortuum*), are intimately mixed and melted in a Hessian crucible until the ingredients are perfectly combined, but no longer. A longer fusion has an injurious effect, as is the case with lemon color, and changes the golden yellow color into a dirty yellowish grey.

Deep yellow, No. 2.—20 parts of minium, 2·5 of white sand, 4·25 of antimoniate of potash, 1 of oxide of iron (*caput mortuum*), 1 of oxide of zinc, are carefully mixed and melted in a Hessian crucible. A longer fusion has not, in this case, the injurious influence as in the preceding colors; and over or in contact with this color may be laid iron-red vitrifiable colors, without its being destroyed or injured.

In painting landscapes and figures, it is important to prepare yellow colors which are easy of fusion, in order to be able to use them upon or under other colors, without any fear of the colors laid on or under them melting away. This property is communicated to them by the addition of Naples yellow; which may be advantageously prepared for this purpose by exposing to a high and continuous heat a mixture of 1 part of stibial tartar, 2 of nitrate of lead, and 4 of marine salt, calcined in a Hessian crucible, and afterwards washing with water the residuum of calcination. By means of the mixture of thin Naples yellow with glass of lead, yellow colors may be produced, which may be advantageously used, but are more expensive than that above given. For instace,—a fine yellow color for painting landscapes may be prepared by mixing 8 parts of Naples yellow and 6 of glass of lead (which is prepared by melting together 2 parts of minium, 1 of white sand, and 1 of calcined borax).

Upon looking at the porcelain through a microscope after the firing operation, colors prepared with antimony do not present the appearance of homogeneous glass of a yellow color, but appear like a mixture of a yellow transparent color (antimoniate of lead), and of a colorless glass.

Uranium yellow.—Mix intimately 1 part of oxide of uranium, 4 of glass of lead (prepared by melting together 8 parts of minium and 1 of white sand), and grind them fine, under the mullet, upon glass:—this color does not blend readily with other colors, forming with them very inferior colors. In order to give it various shades, the colors used are dark purple or violet.

Uranium orange.—Mix carefully 2 parts of oxide of uranium, 1 of chloride of silver, 3 of glass of bismuth (prepared by melting together 4 parts of oxide of bismuth and 1 of crystallized boric acid), and grind fine upon glass. This orange color is like the preceding one, unsuited for mixing with other colors. On examining these colors with a microscope, after firing, they present the appearance of a glass of a pale yellow color, holding in suspension oxide of uranium (unaltered); there is also a small portion of oxide of uranium dissolved in the melted mass.

GREEN COLORS.

Ten parts of chromate of protoxide of mercury and 1 of oxide of cobalt (chemically pure) are finely ground together upon glass, and heated in a glass tube, open at both ends, until the mercury is entirely driven off. The fine bluish color thus obtained, is turned into a porcelain crucible, the cover of which is luted with enamel or glaze. The crucible thus charged is submitted to the hottest fire of the porcelain oven; when cool the charge is removed, by breaking the crucible, and washed, in order to remove the small quantity of chromate of potash which it contains. A compound is thus obtained of oxides of chrome and cobalt, combined in nearly equal proportions, of a bluish green color.

This vitrifiable bluish-green color consists of an intimate mixture of 1 part of chromo-cobaltic oxide, 0·5 of oxide of zinc, 5 of glass of lead (prepared by fusing together 2 parts of minium, 1 of white sand, and 1 of calcined borax), which is ground fine upon glass. By mixing this bluish-green with lemon color, any desired intermediate color may be produced:—1 part green and 6 of lemon color will produce a fine grass-green.

Dark green.—Chromate of mercury (by itself) is treated in the same manner as previously described for mixing with oxide of cobalt for green; and 1 part of the fine green of oxide of chrome, thus obtained, is mixed with 3 parts of the same glass of lead, the formula of which was given for the blue;—it is then finely ground upon glass.

Green for mixing.—8 parts of chromate of mercury and 1 of oxide of cobalt are intimately mixed and exposed in a flat capsule to the strongest heat of the porcelain furnace. A chromo-cobaltic oxide is thus obtained, of a greenish black color, which, on being mixed with twice its weight of glass of lead, of the same kind as that described for the bluish-green, gives a very fluid blackish-green color, suitable for mixing with other green colors, and giving them the required shades.

On examining with a microscope thin scales of the chrome-green color, after being burnt on porcelain, it will be seen that the particles of the oxide of chrome, or of the chromo-cobaltic oxide, are not fused, but are suspended in a colorless glass of lead.

BLUE COLORS.

Deep blue.—1 part of oxide of cobalt (chemically pure), 1 of oxide of zinc, 1 of glass of lead (prepared by fusing together 2 parts of minium, 1 of sand, and 1 of calcined borax), 4 of glass of lead (prepared by fusing together 2 parts of minium and 1 of white sand), are to be well mixed, and melted in a porcelain crucible, at a red heat, during at least 3 hours, and washed and ground fine upon glass. On cooling slowly, this color will be found to consist of a mass of needle-like crystals. Fusion is required to be maintained for a long time, at a moderate temperature, to obtain a fine bold color; and, consequently, the operation is most successfully performed in the second compartment or dome of the furnace. In this manner the fusion of the glass of lead will be most advantageously effected.

Light blue.—1 part oxide of cobalt, 2 of oxide of zinc, 6 of glass of lead (prepared by fusing together 2 parts of minium and 1 of white sand) 1·5 of flux (prepared by the fusion of 2 parts of minium, 1 of white sand, and 1 of calcined borax), are intimately mixed and melted in the same manner as for dark blue.

Blue for mixing.—10 parts of oxide of cobalt, 9 of oxide of zinc, 25 of glass of lead (prepared by fusing 2 parts of minium, 1 of white sand, and 1 of calcined borax), are well mixed and melted as for dark blue. This color is only fit for mixing with the two other blues, by applying it either under or over, for which it is rendered peculiarly applicable from its being very easily fused.

Azure.—Mix well 2 parts of deep blue, 1 of oxide of zinc, 4 of glass of lead (prepared by the fusion of 4 parts of minium and 1 of white sand), and grind fine upon glass. This color is only suitable, either alone or mixed with others, for painting the skies in landscapes.

The vitrifiable blue colors above mentioned, on being inspected through a microscope, after being burnt on to the porcelain, do not present the appearance of homogeneous blue glass, but look like a mixture of a blue translucid substance (silicate of cobalt and zinc) and of a colorless glass.

Turquoise blue.—3 parts of oxide of cobalt (chemically pure) and 1 of oxide of zinc are dissolved in sulphuric acid, to which is added a solution of 40 parts of ammoniacal alum. This mixture of solutions is evaporated to dryness, and the residuum heated until the water is completely driven off; it is then pulverized and submitted, in a crucible, to a bright red heat during several hours. The finest color is that produced in the globe part or dome of the furnace. It is a combination of about 4 equivalents of alumina, 3 of oxide of cobalt, and 1 of oxide of zinc, of a fine turquoise blue color. Any deviation from the proportions above given will produce an inferior color.

If a greenish shade be required, this is effected by mixing with the solution, above mentioned, of ammoniacal alum, zinc, and cobalt, some chromate of protoxide of mercury, recently precipitated and still damp. With the proportions above mentioned 1-16th of chromate of mercury, in a dry state, is sufficient for this purpose.

The vitrifiable turquoise blue color is prepared by mixing 1 part of the compound of alumina and oxides of cobalt and zinc with 2 of glass of bismuth, which is prepared by fusing together 5 parts of oxide of bismuth and 1 of crystallized boric acid.

The formula given in Brongniart's *Traité des Arts Céramiques*, for the preparation of turquoise blue, is incorrect, inasmuch as a flux, composed as there indicated (3 parts of minium, 1 of sand, 1 of boric acid), will, on fusion, completely destroy the body which is colored turquoise-blue,—which is thus converted into a dirty bluish-grey color.

On inspecting through a microscope the turquoise blue color when on the porcelain, it presents the appearance of a mixture of a translucid blue body and a colorless glass. The translucid blue body appears to be the alumine-oxide of cobalt and zinc, which is of itself transparent: this transparency is, by the glass of bismuth surrounding it, increased to translucidity, as oil would act upon the fibre of paper. The same thing occurs with the blue microscopic particles of other vitrifiable blue colors, which particles consist really of silicates of oxides of cobalt and zinc: this latter, when prepared alone, appears through the microscope to be a pure transparent blue powder.—[*Ibid.*]

Scientific Adjudication.

PRIVY COUNCIL CHAMBER.

Whitehall, July 19th, 1849.

FAULKNER'S PATENT.

Mr. Webster appeared for the petitioner, Mr. Faulkner, for the purpose of obtaining an appointment of a day for hearing the petition for extension of letters patent, dated 7th of August, 1835.

It was stated that the petition had been presented about five weeks since, and within two months of the expiration of the patent.

Lord Brougham, after commenting shortly upon the application being made at so late a period, *refused* it, observing that the patentee might resort to an Act of Parliament for an extension.

LIST OF REGISTRATIONS EFFECTED UNDER THE ACT FOR PROTECTING NEW AND ORIGINAL DESIGNS FOR ARTICLES OF UTILITY.

1849.

June 29. *John Vickery Broughton & Co.*, of Cliff Works, near Wakefield, Yorkshire, for pipe-moulding forceps.

30. *Edward Brooks & Son*, of Russell-street, Birmingham, for an improved water-tight nipple and percussion cap.

July 2. *George Keith*, of 11, Princes-street, Leicester-square, for a machine for dividing ice, salt, &c.

4. *Dr. Ellis*, of Sudbrook Park, Petersham, Surrey, for a graduated glass double aperient fountain.

5. *Charles Hart*, of the Valley of White Horse Iron Works, Wantage, Berks, for an improved plough-head.

5. *Thomas Evans*, of 24, Southampton-street, Strand, manufacturer of collars, stocks, fronts, &c., for a fastening for collars, stocks, shirts, and fronts.

6. *J. Davies*, of 16, King's Head-court, Holborn, engineer and machinist, and *Charles Maltby*, of 17, Wood-street, Gray's-Inn-road, engineer and machinist, for a rotary self-acting tobacco-pipe machine.

6. *William Goose*, of Birmingham, for a self-feeding apparatus for nail-machine.

6. *John Smith*, of Corven, near Wolverhampton, for a feeding-apparatus for mill.

6. *Edward Burgess*, of 16, St. John-street-road, Clerkenwell, and 1, Amelia-place, Brompton, for a fire indicator and alarm.

7. *George Harborow*, of 340, Holborn Bars, London, for a shirt collar.

7. *Insole, Jones, & Kimberley*, of Birmingham, for a harness back-band tug.

9. *Francis Edward Colegrave*, of Brunswick-terrace, Brighton, for a constable's staff.

9. *John Whitehead*, of Preston, agricultural machine-maker, for a tile-machine expander.

10. *John Jones*, of 17, Duke-street, Liverpool, for a tailor's symetrometer.

11. *Thomas Allen*, of Radcliffe, Lancashire, for a twine-box.

12. *Simcox & Pemberton*, of Birmingham, for a hinge and door for letter-boxes.

13. *Walter Hart*, of 32, New-road, Brighton, Sussex, for the "Sikh buckle."

13. *Deane, Dray, & Deane*, of King William-street, London Bridge, for an improved alarum letter-box.

July 14. *James Hardcastle*, of Firwood, near Bolton-le-Moors, Lancashire, bleacher, dyer, and finisher, for an improved calendar, for finishing muslins and other goods requiring such process.

14. *Bedington & Docker*, of 62, Rea-street, Birmingham, and 2, Barge-yard, Bucklersbury, London, for a solar shade for the outside of windows.

16. *Victor D'Anglars*, of Elm Cottage, Lymington, Hants, for the "Epicurean oven for the million."

16. *Charles Burrell*, of St. Nicholas Foundry, Thetford, Norfolk, for a gorse machine.

16. *Charles Burrell*, of St. Nicholas Foundry, Thetford, Norfolk, for a corn-dressing machine.

16. *John Heather*, of 3, Bedford-court, Covent Garden, for Madame Blangy's Parisian hundo cloth petticoat.

18. *John Chubb*, of 57, St. Paul's-churchyard, London, patent lock and fireproof safe manufacturer, for an improved railway strong box, with a small receiving door and safety slider in its lid.

19. *Charles Clarke*, trading under the style of Loach and Clarke, of 62½, Little Charles-street, Birmingham, brass-founders, for an improved letter-box plate; applicable also to door-knockers.

19. *Clayton, Shuttleworth, & Co.*, of Stamp End Works, Lincoln, engineers, &c., for a portable corn-mill.

19. *William Handley*, of 43, Chandos-street, Strand, for a soil-pan valve.

20. *William Stedman Gillett*, of Woburn-place, Russell-square, for a diaphragm to be used with a microscope.

23. *Auguste Motte*, of 9, Southwark-square, Southwark, for an improved portmanteau.

23. *Richard Bell*, of Basing-lane, for a fuzee-cutting die.

25. *Mary Jane Rumney*, of 1, Church-terrace, Liverpool-street, Walworth, for a brooch protector and pin-cap.

26. *George Price*, of Birmingham, for a stove.

List of Patents

That have passed the Great Seal of IRELAND, from the 17th June to the 17th July, 1849, inclusive.

To Robert Brett Schenck, late of New York, in the United States of America, but at present of Belfast, in the county of Antrim, manufacturer, for a machine for buffing and scutching flax, hemp, and other fibrous substances.—Sealed 18th June.

James Hamilton, of London, civil engineer, for improvements in cutting wood.—Sealed 28th June.

Michael Loam, of Treskerley, in the parish of Gwennap, in the county of Cornwall, engineer, for improvements in the manufacture of fuzees.—Sealed 30th June.

David Smith, of the City of New York, in the United States of America, lead manufacturer, and a citizen of the said United States, for certain new and useful improvements in the means of manufacturing certain articles in lead.—Sealed 7th July.

William Newton, of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, civil engineer, for improvements in the Jacquard machine,—being a foreign communication.—Sealed 11th July.

List of Patents

Granted for SCOTLAND, subsequent to June 22nd, 1849.

To David Smith, of New York, United States of America, lead manufacturer, for certain new and useful improvements in the means of manufacturing certain articles in lead.—Sealed 25th June.

Edmund Grundy, of Bury, in the county of Lancaster, woollen manufacturer, and Jacob Farrow, of the same place, manager, for certain improvements in machinery or apparatus for preparing wool for spinning; and also improvements in machinery or apparatus for spinning wool and other fibrous substances.—Sealed 25th June.

Walter Neilson, of Hyde Park-street, Glasgow, engineer, for an improvement or improvements in the application of steam for raising, lowering, moving, or transporting heavy bodies.—Sealed 25th June.

Robert William Laurie, of Carlton-place, Glasgow, merchant, for improvements in means or apparatus to be employed for the preservation of life and property; such improvements, or parts thereof, being applicable to various articles of furniture, dress, and travelling apparatus.—Sealed 29th June.

Edward Hawkins Payne, of Great Queen-street, London, coach-lace manufacturer, and Henry William Currie, engineer, for improvements in the manufacture of coach-lace, and other similar looped or cut pile fabrics.—Sealed 9th July.

Robert Urwin, of Ashford, Kent, engineer, for certain improvements in steam-engines; which may in whole or in part be applicable to pumps and other machines not worked by steam power.—Sealed 9th July.

William Wilson, jun., residing at Campbellfield, Glasgow, for improvements in cutting plastic tubes or tiles.—Sealed 10th July.

James Godfrey Wilson, of Millman-row, Chelsea, London, engineer, for certain improvements in obtaining perfect combustion, and in apparatus relating thereto; the same being applicable generally to furnaces and fire-places; as also to other purposes where inflammable matter or material is made use of.—Sealed 11th July.

William Kenworthy, of Blackburn, cotton-spinner, for certain improvements in power-looms for weaving.—Sealed 16th July.

William Crofton Moat, of Upper Berkeley-street, London, surgeon, for improvements in engines to be worked by steam, air, or gas.—Sealed 16th July.

George Benjamin Thorneycroft, of Wolverhampton, iron-master, for improvements in manufacturing railway tyres, axles, and other iron, where great strength and durability is required.—Sealed 16th July.

Edward Ives Fuller, of Margaret-street, Cavendish-square, London, carriage-builder, and George Tabernacle, of Mount-row, Westminster-road, coach iron-founder, for certain improvements in metallic springs for carriages.—Sealed 17th July.

Peter Augustine Godefroy, of Wilson-street, Finsbury-square, London, chemical color manufacturer, for certain improvements in dressing and finishing woven fabrics.—Sealed 18th July.

John Grantham, of Liverpool, engineer, for improvements in sheathing ships and vessels.—Sealed 18th July.

Joseph Eccles, of Moorgate Fold Mill, near Blackburn, in the county of Lancaster, cotton-spinner and manufacturer, and James Bradshaw and William Bradshaw, of Blackburn, watchmakers, for certain improvements in and applicable to looms for weaving various descriptions of plain and ornamental textile fabrics.—Sealed 19th July.

New Patents
SEALED IN ENGLAND.
1849.

To Thomas Greenwood, of Goodman's Fields, in the City of London, sugar refiner, and Frederick Parker, of New Gravel-lane, Shadwell, animal-charcoal manufacturer, for improvements in filtering syrups and other liquors. Sealed 4th July—6 months for inrolment.

John Robinson, of Patterson-street, Stepney, in the county of Middlesex, engineer, for improvements in machinery for moving and raising weights. Sealed 4th July—6 months for inrolment.

John Grantham, of Liverpool, engineer, for improvements in sheathing ships and vessels. Sealed 4th July—6 months for inrolment.

Josiah Bowden, of Liskeard, linen-draper, and William Longmaid, of Beaumont-square, in the county of Middlesex, Gent., for improvements in the manufacture of soap. Sealed 4th July—6 months for inrolment.

John Browne, of Great Portland-street, Portland-place, in the county of Middlesex, Esq., for improvements in apparatus to assist combustion in stoves or grates. Sealed 4th July—6 months for inrolment.

Sir Francis Charles Knowles, of Lovell, in the county of Berks, Bart., for improvements in the production and manufacture of iron and steel. Sealed 4th July—6 months for inrolment.

Richard Archibald Brooman, of Fleet-street, in the City of London; for improvements in steam generators,—being a communication. Sealed 4th July—6 months for inrolment.

James Mulbery, of Parkersburgh, in Chester county and State of Pennsylvania, in the United States of America, machinist, for certain improvements in the slide-valves of steam-engines. Sealed 4th July—6 months for inrolment.

William Henry Wilding, of the New-road, in the county of Middlesex, Gent., for certain improvements in engines and machinery for obtaining and applying motive power. Sealed 4th July—6 months for inrolment.

Robert William Thomson, of Leicester-square, in the county of Middlesex, civil engineer, for certain improvements in writing and drawing instruments. Sealed 4th July—6 months for inrolment.

William Bush, of Great Tower-street, in the City of London, civil engineer, for improvements in lamps and in lighting,—being partly a communication. Sealed 4th July—6 months for inrolment.

John Combe, of Leeds, in the county of York, civil engineer, for improvements in machinery for heckling, carding, winding, dressing, and weaving flax, cotton, silk, and other fibrous substances. Sealed 4th July—6 months for inrolment.

William Henry Brown, of Ward's End Wheel, at Wadsley, in the parish of Ecclesfield, in the county of York, steel roller, for an improvement in rolls for rolling flat and half-round file and other iron and steel. Sealed 4th July—6 months for ininrolment.

Pierre Augustin Chauffourier, of Regent's Quadrant, in the county of Middlesex, merchant, for improvements in castors,—being a communication. Sealed 4th July—6 months for inrolment.

Henry Bailey, of Wolverhampton, in the county of Stafford, chemist, for certain improvements in the construction of articles of wearing apparel; which improvements are also applicable to fastenings for the same. Sealed 4th July—6 months for inrolment.

Robert Weare, of Argyle-street, Birkenhead, in the county of Cheshire, clock and watch-maker, and William Peter Piggott of Wardrobe-place Doctors' Commons, in the county of Middlesex, mathematical instrument maker, for certain improvements in electric batteries and in the production of light; also a mode of transmitting or communicating intelligence for the better protection of life and property,—parts of which improvements are applicable to other like purposes. Sealed 4th July—6 months for inrolment.

Richard Garrett, of Leiston Works, near Saxmundham, in the county of Suffolk, agricultural implement-maker, for improvements in horse-hoes, pug-mills, drilling and thrashing machinery, and in steam engines and boilers for agricultural purposes. Sealed 7th July—6 months for inrolment.

Edward Ives Fuller, of Margaret-street, Cavendish-square, in the county of Middlesex, carriage builder, and George Tabernacle, of Mount-row, Westminster-road, in the county of Surrey, coach iron founder, for certain improvements in metallic springs for carriages. Sealed 7th July—6 months for inrolment.

Thomas Sedgwick Summers, of 6, Cornwall-terrace, Lee, Kent, lighterman and warehousekeeper, for certain improvements in fastenings for the mouths of sacks and bags. Sealed 9th July —6 months for inrolment.

Robert William Laurie, of Carlton-place, in the City of Glasgow, North Britain, merchant, for improvements in means or apparatus to be employed for the preservation of life and property; such improvements, or parts thereof, being applicable to various articles of furniture, dress, and travelling apparatus. Sealed 9th July—6 months for inrolment.

John Goodier, of Mode Wheel Mills, near Manchester, in the county of Lancaster, miller, for certain improvements in mills for grinding wheat and other grain. Sealed 9th July—6 months for inrolment.

George Augustus Robinson, of Long Melford, in the county of Suffolk, Gent., and Richard Egan Lee, of Glasgow, Gent., for certain improvements in the manufacture of bread, and in the machinery or apparatus to be used therein; and also improvements in the regulation of ovens and furnaces; part of which improvements are also applicable to other similar useful purposes. Sealed 10th July—6 months for inrolment.

George Cottam and Edward Cottam, of Winsley-street, Oxford-street, in the county of Middlesex, engineers, for improvements in machinery for cutting straw, clover, and hay, for grinding, for sawing wood, and in apparatus for ascertaining the power employed in working machines. Sealed 12th July—6 months for inrolment.

John Holland, of No. 2, Lark Hall Rise, in the parish of Clapham, in the county of Surrey, Gent., for a new mode of making steel,—being a communication. Sealed 18th July—6 months for inrolment.

Reuben Plant, of Holly Hall Colliery, near Dudley, in the county of Worcester, coalmaster, for improvements in making bar or wrought iron. Sealed 18th July—6 months for inrolment.

Andrew Peddie How, of the United States, now residing in Basinghall-street, in the City of London, engineer in the United States navy, for an instrument or instruments for ascertaining the saltness of water in boilers,—being a communication. Sealed 18th July—6 months for inrolment.

Evan Leigh, of Ashton-under-Lyne, in the county of Lancaster, cotton-spinner, for certain improvements in steam-engines, and also improvements in communicating steam or other power for driving machinery. Sealed 18th July—6 months for inrolment.

Thomas Walker, of Birmingham, stove-manufacturer, for improvements in boots and shoes, and in the manufacture of parts of boots, shoes, clogs, and goloshes. Sealed 18th July—6 months for inrolment.

James Usher, of Edinburgh, Gent., for improvements in machinery for tilling land. Sealed July 18th—6 months for inrolment.

William Brown, of St. James's, Clerkenwell, in the county of Middlesex, machinist; Henry Mapple, of Child's Hill, in the Parish of Hendon, in the same county, electric engineer; and William Williams, the younger, of Birmingham, in the county of Warwick, Gent., for improvements in communicating intelligence by means of electricity, and improvements in electric clocks. Sealed 18th July—6 months for inrolment.

Samuel Cunliffe Lister, of Bradford, in the county of York, Esq., and George Edmond Donisthorpe, of Leeds, in the same county, manufacturer, for improvements in preparing, combing, and spinning wool,—partly a communication. Sealed 18th July—6 months for inrolment.

Alexander Ferrier Rose, of Greenvale-place, Glasgow, Gent., for a certain improvement or certain improvements in the process or operation of printing, and in the machinery or apparatus employed therein. Sealed 24th July—6 months for inrolment.

John Holt, of Todmorden, in the county of Lancaster, manager of the Waterside Works, for improvements in machinery or apparatus for preparing cotton and other fibrous substances; parts of which improvements are applicable to machinery used in weighing. Sealed 24th July—6 months for inrolment.

Joseph Woods, of Barge-yard Chambers, Bucklersbury, in the City of London, civil engineer, for improvements in bleaching certain organic substances, and in the manufacture of certain products therefrom,—being a communication. Sealed 24th July—6 months for inrolment.

CELESTIAL PHENOMENA FOR AUGUST, 1849.

D.	H.	M.	
1			♅ stationary
—			Clock before the ☉ 6m. 1s.
—			☽ rises 5h. 55m. A.
—			☽ passes mer. 10h. 19m. A.
—			☽ sets 1h. 55m. M.
—			Occul. *d* Sagittarii, im. 14h. 44m. em. 15h. 35m.
4			Ecliptic oppo. or ○ full moon
	9	50	☿ in Perihelion
5			Clock before the ☉ 5m. 42s.
—			☽ rises 8h. 18m. A.
—			☽ passes mer. 0h. 44m. M.
—			☽ sets 5h. 46m. M.
8	0	58	♄ in conj. with the ☽ diff. of dec. 0. 30. N.
9	8	12	♅ in conj. with the ☽ diff. of dec. 3. 48. N.
10			Clock before the ☉ 5m. 4s.
—			☽ rises 10h. 30m. A.
—			☽ passes mer. 4h. 43m. M.
—			☽ sets 11h. 38m. M.
11	1	33	☽ in □ or last quarter
	20	33	♂ in conj. with the ☽ diff. of dec. 4. 12. N.
12	12	0	Ceres in conj. with B.A.C. 6127, diff. of dec. 0. 57. N.
13			Pallas stationary
—			Occul. 130 Tauri, im. 12h. 52m. em. 13h. 42m.
14	11	50	♀ in conj. with the ☽ diff. of dec. 2. 6. N.
	17	48	☿ greatest hel. lat. N.
15			Clock before the ☉ 4m. 13s.
—			☽ rises 1h. 26m. M.
—			☽ passes mer. 9h. 24m. M.
—			☽ sets 5h. 19m. A.
	3	0	☽ in Perigee
16	2	2	☿ in sup. conj. with the ☉
	5	20	Juno in conj. with ♃ diff. of dec. 3. 39. S.
17			☉ eclipsed, invis. at Greenwich
—			Mercury R. A. 9h. 52m. dec. 14. 44. N.
—			Venus R. A. 6h. 45m. dec. 20. 58. N.
—			Mars R. A. 4h. 8m. dec. 19. 52. N.
17			Vesta R. A. 6h. 17m. dec. 20. 41. N.
—			Juno R. A. 10h. 15m. dec. 8. 11. N.
—			Pallas R. A. 17h. 18m. dec. 16. 56. N.
—			Ceres R. A. 17h. 58m. dec. 29. 29. S.
—			Jupiter R. A. 10h. 14m. dec. 11. 52. N.
—			Saturn R. A. 0h. 30m. dec. 0. 33. N.
—			Georg. R. A. 1h. 38m. dec. 9. 33. N.
—			Mercury passes mer. 0h. 9m.
—			Venus passes mer. 21h. 3m.
—			Mars passes mer. 18h. 24m.
—			Jupiter passes mer. 0h. 31m.
—			Saturn passes mer. 14h. 45m.
—			Georg. passes mer. 15h. 52m.
	22	26	☿ in conj. with the ☽ diff. of dec. 2. 21. N.
18			Ceres stationary
	5	1	♃ in conj. with the ☽ diff. of dec. 1. 4. N.
	0	33	Ecliptic conj. or ● new moon
20			Clock before the ☉ 3m. 10s.
—			☽ rises 7h. 29m. M.
—			☽ passes mer. 2h. 0m. A.
—			☽ sets 8h. 19m. A.
	5	6	☿ in conj. with ♃ diff. of dec. 0. 51. N.
	19	17	☿ in conj. with Juno, diff. of dec. 4. 19. N.
21			Occul. 130 Tauri, im. 12h. 52m. em. 13h. 42m.
25			Clock before the ☉ 1m. 54s.
—			☽ rises 1h. 4m. A.
—			☽ passes mer. 5h. 52m. A.
—			☽ sets 10h. 34m. A.
	4	56	☽ in □ or first quarter
26	3	48	♃ in conj. with the ☉
	23	0	☽ in Apogee
30			Clock before the ☉ 0m. 27s.
—			☽ rises 5h. 14m. A.
—			☽ passes mer. 9h. 50m. A.
—			☽ sets 1h. 31m. M.

The Eclipses of the Satellites of Jupiter are not visible this month, Jupiter being too near the Sun.

J. LEWTHWAITE, Rotherhithe.

THE

LONDON JOURNAL,

AND

REPERTORY

OF

Arts, Sciences, and Manufactures.

CONJOINED SERIES.

No. CCXIII.

RECENT PATENTS.

To Peter Fairbairn, *of Leeds, in the county of York, machine-maker, for improvements in machinery for heckling, carding, drawing, roving, and spinning flax, hemp, tow, silk, and other fibrous substances.*—[Sealed 26th October, 1848.]

This invention consists, firstly, in the peculiar adaptation of a rotary gill or porcupine roller to a machine for drawing out the fibres or elongating the sliver of flax or hemp; the rotary gill being employed solely for the purpose of opening or separating the fibres of the material immediately in the vicinity of the drawing-rollers. In the usual machinery employed for drawing out the fibres, a series of travelling bars, with heckle pins, have been employed between the holding and the drawing-rollers. It has, however, been found that, in passing the sliver, in the process of drawing, between the series of heckle-pins of the gill machinery heretofore in use (whether on the sheet, screw, or circular construction), the fibres, being held between the pins of the gills, were broken as the drawing went on, and the staple was thereby reduced in length and strength, to the injury of the yarn produced by the after process of spinning.

Now, in this improved construction of machinery, the patentee states that it is not requisite to have a series of gill-pins, as heretofore, extending backward to the length of the staple or fibres of the material under the process of drawing; the ends only, or those parts of the fibres in the immediate vicinity of the bite of the drawing-rollers, requiring to be kept open or disentangled: the above-mentioned previously existing evils will be therefore avoided. The further advantages derivable from this improved machinery are, an increase of the draft of the sliver, to the extent of two or three times the amount which has hitherto been obtained or is now generally practised; also avoiding the bending the fibres over the gill-roller (which takes place in drawing tow,—the gill being, in that instance, a holder of the fibres). In the improved machinery the fibres merely pass tangentially between the pins of the rotary gill—simply separating and opening the sliver for the better operation of the drawing-rollers.

In Plate IV., fig. 1, represents, in sectional elevation, a portion of the improved drawing-machine; and fig. 2, is a plan view of the same. *a, a,* are the retaining-rollers, between which the sliver is conducted onward. These rollers are kept revolving at an uniform speed by means of the toothed wheels *b, b,* which are fixed upon their respective axles, and, being in gear with each other, cause the retaining-rollers to revolve simultaneously, and the whole substance of the sliver to advance uniformly. The sliver proceeds onwards between the carrying-rollers *c, c,* and *d, d,* to the rotary gill-pins, fixed to the axle *e,* and thence to the drawing-rollers *f,* and *g.* On the axle of the lower drawing-roller *f,* a pinion *h,* is fixed (see fig. 2,) taking into an intermediate wheel *i*; and this wheel *i,* drives the wheel *k,* fixed on the end of the intermediate shaft *l,* which extends the whole length of the machine. Upon this shaft also are fixed a series of pinions *m,* taking into pinions *n,* on the shafts of the rollers *g,* which connections are for the purpose of driving each pair of top drawing-rollers *g,* simultaneously with the bottom drawing-rollers. The object of gearing the drawing-rollers together is to insure a perfect uniformity of rotary motion between each pair, whereby a less amount of weight or pressure upon the top drawing-roller will be required, and the fibres will be more perfectly drawn out.

The second feature of the invention consists in an adaptation of the foregoing arrangement of machinery to the spinning of yarns direct from the slivers. The practice hitherto pursued has been to spin from slightly twisted fibres, that is, rovings, and, in consequence of the twist retained in such rovings, a great impediment is experienced in drawing out the fibres in their entire lengths; for, in effecting this drawing of the twisted rovings, the fibres are to a considerable extent broken, and the yarns thereby rendered weaker and rough on their surface.

Fig. 3, represents, in front elevation, part of a spinning-machine, with the improved drawing-apparatus adapted thereto. Fig. 4, is a side elevation of the same. *a, a,* are the retaining-rollers, which are kept revolving at an uniform speed by means of the toothed-wheels *b, b,* fixed upon their respective axles; the sliver thence passes between the rollers *c, c,* and *d, d,* and proceeds to the gill-roller *e*. This rotary gill prevents the fibres becoming entangled, and opens the sliver as it proceeds to the drawing-rollers *f, g,* where the foremost fibres are taken in the bite, and drawn onward unbroken. By this improved mode of spinning from untwisted slivers, a much more uniform yarn is said to be obtained; it being smoother on the surface (technically denominated a better skin) and the fibres being more perfectly combined than by the ordinary operations of spinning from twisted rovings. By employing this improved machinery in the process of spinning, the operation of roving will be no longer requisite, and consequently the great cost and labor attendant upon the employment of roving machines will be saved.

The third feature of the invention refers to the adaptation of gill-drawing apparatus to machines for carding tow or short-fibred flax. It has hitherto been the practice to receive the slivers from carding-engines into deep vertical cans, and from those cans to take the sliver, and perform the first drawing process in a separate machine. These fibres of carded sliver, previous to drawing, being in the form of a thin ribbon of slight tenacity, are very liable to be damaged in being pressed down into the cans which receive them from the carding-machine, and also in their progress from the cans to the retaining-rollers of the drawing-machines. This is found to be a great disadvantage, as any damage which the slivers may thus receive cannot be easily remedied in any subsequent operation. This head of the invention is designed to obviate these evils, as the sliver, after it is discharged from the delivering-rollers of the carding-machine, is directly taken hold of by the retaining-rollers or pricking-in rollers, and carried at a uniform speed to the gills, over which it is attenuated and extended by the drawing-rollers, and rendered in a fit state to be conveyed to the second drawing-machine, or to the roving-machine, as the case may be; the sliver being in this state less liable to injury than before.

At fig. 5, part of a carding-engine is represented in sectional elevation, to which one example of the improvement is attached, viz.,—the adaptation of the rotary gill drawing apparatus to a carding-engine. *a, a,* are the delivering-rollers of the carding-engine; *b,* is the retaining or pricking-in roller; *c,* is the rotary gill; *d,* and *e,* are the drawing-rollers; and *f,* and *g,* are the rollers which deliver the drawn sliver. By this arrangement a considerable economy is said to be effected; for, by attaching a drawing apparatus to the carding-engine, the patentee is enabled to dispense with the usually detached first drawing-machine; and it is now only required to use in addition a second drawing-machine to complete the drawing process.

The fourth feature of the invention applies to the clearers or rubbers of drawing and roving-machines. The revolving-clearers or rubbers, hitherto in use, are frequently the cause of accidents; for, in consequence of the wheels being exposed, the attendants are liable to have their fingers drawn between them. This evil is obviated by covering the wheels with a case, which also serves the purpose of a radial arm, to carry and keep the wheels in gear with each other. At fig. 6, a portion of a roving-machine, with the improved adaptation of revolving clearers or rubbers, is shewn in elevation. Fig. 7, is a horizontal section of the rubbers, with the case in which their driving-wheels revolve. One of the ordinary upper drawing-rollers of the machine is represented at *r*; and *s, s,* are two revolving rubbers, acting on the periphery of the upper drawing-roller. A pair of toothed-wheels *t, t,* upon parallel axles, are employed for giving rotary motion to the rubbers; and *u, u,* is the cap-case or cover, which not only shields the driving-wheels of the rubbers, but also answers the purpose of a radial arm, carrying the axle of the rubbers;—the case rising with the axles of the rubbers, as a lever upon the driving-shaft *w,* which forms the fulcrum.

The fifth feature of the invention consists in a novel pawle and ratchet weight-lever, to be used for giving the pressure required upon the drawing-rollers of spinning-machines, by which, as the pressing-roller becomes reduced in its diameter by wear, a more ready and economical means is attained of advancing it toward the drawing-roller than by the ordinary adjusting nut and screw, as heretofore used.

Fig. 8, represents, in side elevation, a portion of a spinning-frame, with the improved pawle and ratchet weight-lever attached; and fig. 9, is a horizontal view of the same apparatus. *a,* and *b,* are the drawing-rollers; and *c,* is the weighted lever for pressing the roller *b,* against the roller *a.* This weighted lever *c,* is hung upon a fulcrum-pin in the small bracket *d*; which bracket is fixed to the beam *e,* extending along the frame of the machine. In the shorter arm of the weighted lever *c*, a pawle *f*, is mounted upon a fulcrum-pin; which pawle is intended to take into a ratchet in the piece *g*, whereby the roller *b*, is forced up against the roller *a*. This piece *g*, is a small loose bar, passing freely through a slot in the lower part of the shorter arm of the lever *c*. The upper end of this piece *g*, is forked, and bears against the axle of the drawing-roller *b*, for the purpose of forcing the periphery of the roller *b*, up into contact with the roller *a*. In the upper edge of this forked piece *g*, a series of ratchet-teeth are cut, into which the end of the pawle *f*, is let fall; and hence, by the force of the weighted lever *c*, the pawle *f*, is made to drive the piece *g*, and the roller *b*, up against the roller *a*, by which the contact of the drawing-rollers is effected. It will hence be perceived, that, in the event of the periphery of the pressing-roller *b*, becoming worn away or reduced in diameter by use, the forked piece *g*, may be advanced, and the roller be thereby pushed up to its bearing, by placing the pawle in one of the backward teeth of the ratchet;—the roller *b*, being thus held firmly by the pressure of the weighted lever.

The sixth feature of the invention applies to the gearing of machines for heckling, carding, drawing, roving, and spinning flax, hemp, tow, and other fibrous materials; and is designed to effect a ready mode of connecting two or more shafts by means of intermediate wheels; so that the change-pinion may be altered with facility to any required diameter. Fig. 10, shews, in elevation, a portion of the end of a roving-frame, with the improved apparatus adapted in two examples, viz.,—in the instance where one intermediate wheel is used, and also in the instance where two intermediate wheels are used. In this figure, where one intermediate wheel is used, *a*, is the change-pinion; *b*, is the intermediate wheel; *c*, is the driven wheel on the axle *e*, of the front drawing-roller of a roving-machine; and *d*, is an adjustable radial arm, moveable upon its fulcrum at *e*. In this radial arm *d*, there is a long slot formed in a segmental curve *f*, concentric with the fulcrum *e*. A bolt *g*, is passed through a bracket on the side of the frame, and through this curved slot; and when the arm *d*, has been moved on its fulcrum to the required situation, a nut, screwed up tight on the bolt *g*, holds the arm securely in this position. The lower part of the radial arm has a stud *h*, fixed in it, on which the intermediate wheel *b*, is mounted and revolves. The change-pinion *a*, may be removed, and a larger pinion or wheel placed on its stud, as shewn by the dotted circle; and when this is done, the intermediate wheel and radial arm will assume the position also shewn by dots in the figure.

Where more intermediate wheels are required for driving other parts of machinery, a similar moveable radial arm is adapted, as shewn in the upper part of fig. 10. Upon the axle of the front drawing-roller *e*, as a fulcrum, the adjustable radial arm *i*, *i*, is mounted, which carries the axles of the intermediate wheels *j*, and *k*. These wheels are driven by the change-pinion *l*, fixed upon the back shaft *m*, of the roving-machine. In the event of employing a change-pinion *l*, of larger diameter, the arm *i*, with its wheels, may be raised, as shewn by dots (a segmental slot in the side branch of the arm *i*, allowing of its elevation, as shewn by dots); and in this position the arm and the wheels may be held securely, by a nut, upon the bolt *n*, passed through the segmental slot of the arm *i*, and through a standard piece *p*, on the end frame.

The seventh feature of the invention is a novel mode of connecting the counter-shaft of a roving-machine with the shaft that drives the bobbins. This is effected through a train of wheels, mounted on a jointed arm, suspended upon a fulcrum; by means of which the bobbin-shaft may be allowed to move up and down to effect the required traverse, and yet retain the said wheels in gear with each other.

Fig. 11, of the accompanying drawings, represents, in elevation, a portion of the end of a roving-frame, with the improved apparatus attached for traversing the bobbin-rail; and fig. 12, is a vertical section, taken through the improved apparatus in the dotted line A, B, of fig. 11. Upon the counter-shaft *a*, is fixed a wheel *b*, which drives the train of wheels *c*, *d*, *e*, *f*. These wheels are mounted and revolve upon studs *g*, *h*, *i*, and *j*, fixed in the vibrating arm or bar *k*; which arm or bar, at one end, hangs loosely upon the stud *g*, fixed in an arm *l*, suspended on the counter-shaft *a*. The wheel *c*, is, by these means, kept in gear with the wheel *b*, and hence the wheels *c*, *d*, *e*, and *f*, all of which are in gear, are caused to revolve together. The end of the bar *k*, is connected at *j*, with a sliding-piece *m*, which is capable of moving up and down, between guides, on the side of the frame of the machine, for the purpose of traversing the copping-rail of the roving-machine, which is effected by ordinary means. In order that these connected wheels may be kept in gear, whatever may be the situation of the copping-rail, the bars *k*, and *l*, assume the positions shewn by dots, by moving upon the joints or fulcrums at *a*, and *g*.

The patentee claims, Firstly,—the adaptation of a rotary or circular gill to a machine for drawing flax and hemp, in such manner that the sliver of flax or hemp, in proceeding from the holding to the drawing-rollers, shall pass through or between the pins of the revolving gill, in the direction of a tangent to its rotary motion, for the purpose of merely opening the fibres of the sliver immediately in the vicinity or bite of the drawing-rollers, without holding back the sliver, or allowing it to lap partially round the gill, as in the instance of drawing the sliver of tow. Secondly,—gearing or connecting together pairs of holding-rollers, and also pairs of drawing-rollers, whatever may be the construction of the gills or machinery to which they may be applicable;—the object being that the pairs of holding and drawing-rollers shall respectively revolve with equal surface speeds, and thereby cause the entire substance of the sliver, in each case, to advance uniformly. Thirdly,—the adaptation and connection of gill-drawing apparatus (of whatever construction) to machines for carding tow, or short-fibred flax, or other materials. Fourthly,—the peculiar construction of a case or shell for covering the wheels of the revolving rubbers or clearers; which case or shell also carries the axle of the said rubber, as shewn in figs. 6, and 7. Fifthly,—the peculiar construction of pawle and ratchet-holder for keeping the drawing-rollers in contact, as described and shewn at figs. 8, and 9. Sixthly,—the adaptation of adjustable radial arms to various constructions of machinery for manufacturing flax and tow; by means of which radial arms, carrying intermediate wheels, several distinct wheels may be actuated, whether such wheels are fixed on shafts, as shewn in the drawing, or mounted loosely upon studs. Lastly,—the arrangement, construction, and adaptation of wheels mounted on a jointed arm or arms, when applied to roving-frames for flax and tow, as shewn at figs. 11, and 12.—[*Inrolled April,* 1849.]

To WILLIAM CLAY, *of Clifton Lodge, in the county of Cumberland, engineer, for certain improvements in machinery for rolling iron or other metals; parts of which improvements are applicable to other machinery in which cylinders or rollers are used.*—[Sealed 16th December, 1848.]

THIS invention is designed to produce, by the process of rolling, bars of taper forms, as, for instance, wedge-shaped bars, or conical bars. The taper forms of bars are obtained by allowing one of the shaping-rollers to recede gradually from the other, as the rolling operation goes on; whereby, the space or distance of the rollers apart becoming enlarged, the metal, in passing between them, assumes a gradually increasing thickness, either in a wedge, conical, or other form, according to the shape of the grooves cut in the rollers.

Various modes of permitting one of the rollers to recede from the other might be devised; but one which the patentee has found well suited to the purpose consists in the adaptation to rolling machinery of pistons bearing against confined columns of water or other non-elastic fluid,—the ends of the piston-rods maintaining or affording the means of keeping the bearings of the rollers from shifting their positions, excepting as the columns of water are allowed to relax their resistance by a slow and gradual escape of the fluid from the cylinder or chamber through an adjustable valve. The apparatus, arranged for this purpose, is shewn in Plate V., wherein fig. 1, represents a vertical section, taken transversely through the head of one of the standards which carry the bearings of the journals of the rollers. In this figure the piston, its rod, and appendages, with the column of water against which the piston bears, and the valve whereby a small quantity of the fluid may be allowed gradually to escape, are all shewn. Fig. 2, represents a partial front view of the rollers; the bearings and part of the regulating apparatus in the head of the standard being shewn in section. It will be understood that two such standards are required to support the ends of the rollers. Fig. 3, is a horizontal section, taken in the line 1, 2, of fig. 1, shewing the parts inverted, or as seen from below; and fig. 4, is another horizontal section, taken on the upper side in the line 3, 4, of fig. 1, shewing the entrance and exit-valves of the water-chamber, and the means of working or regulating the exit-valve.

In the rolling-mills usually employed for rolling bar-iron, the rollers are generally mounted in fixed bearings, or bearings which, during the operation of rolling, are rendered immoveable, by being maintained in their places by strong screws or bolts; but, by this invention, the ends of the bearing A, of the upper roller are let into grooves in the standards, as in ordinary rolling-mills, in such a manner as to admit of their sliding up and down therein, in order that, by so sliding, the parallel distance between the rollers may be allowed to change. The rising of the bearings with the upper roller is regulated and governed by piston-rods *a*, which rest on the top of the bearings,—the upper end of the piston-rod being connected to the solid piston *b*, of the hydraulic cylinder or water-chamber *c*, as shewn at figs. 1, and 2. This cylinder *c*, is filled with water or other non-elastic fluid or liquid, and is furnished with leather or other suitable packing, for the purpose of preventing any leakage. The packing is kept in its place by a metallic ring or plate *d,* which is firmly secured to the body of the cylinder by strong screw-bolts. The cylinder is supplied with water from any convenient source by a lateral tube *p,* shewn in fig. 4, through the rising feed-valve *e;* the construction and operation of which will be clearly understood by referring to the drawing. *f,* is the exit-valve, through which, when partially opened, the water is allowed to escape from the chamber *c,* on pressure being applied to the lower end of the rod *a;* by which pressure the piston *b,* will be made to rise and partially to expel the water, as will be the case when a bar of iron is passed between the shaping-rollers B, B. The valve *f,* is constructed in such a manner that the opening for the discharge of the water, and consequently the rising of the roller and the taper given to the metal, may be regulated with the greatest exactness, by merely advancing or receding the plug *g,* worked by the screw at its back end; the effect of which will be to open or close the valve to any extent that may be required. There is a slight spring behind the plug *g,* which is merely intended to push the plug forward and close the aperture of the valve when the upward pressure of the piston is not in action, as will be the case when the rolling operation is suspended. An additional valve *h,* is also made to communicate with the exit-passage *i.* This valve, however, is always kept closed by a strong spring, as shewn, and will never allow any water to escape this way from the cylinder, except when any extraordinary pressure takes place;—at which time the power of the spring will be overcome, and, by yielding, prevent the machinery from being too greatly strained. This safety-valve may, in conjunction with an hydraulic cylinder and piston, as shewn, be adapted to other rolling machinery, in which pressing-cylinders or rollers are used (such, for instance, as sugar and crushing-mills), for the purpose of allowing one of the rollers to yield to any undue and sudden pressure or strain, which might otherwise derange the machinery.

In introducing into the improved machinery a mass of iron between the shaping-rollers, say for the purpose of producing a wedge-formed bar, having parallel edges, the patentee employs a pair of rollers of the ordinary kind, having the grooves and flanges, as shewn at fig. 2. As the mass of iron is about to be introduced between the rollers in the first groove, the valve *f,* is opened, by withdrawing the screw behind the plug *g,* to such an extent as will allow the escape of water from the chamber *c*, in a small current;—the opening for the intended discharge being regulated according to the required taper of the bar to be formed: the required extent of which opening will readily be found by the experience of the workman. While the operation of rolling is proceeding, the pressure of the metal, in passing between the rollers, will cause the bearings of the upper roller to rise, and force up the piston-rods *a*; in doing which the piston will be made to rise in the chamber *c*; but the ascent of the piston being resisted by the non-elastic fluid in the chamber *c*, the escape of water through the valve *f*, and outlet *i*, must take place to allow of the ascent of the piston, and, consequently, the separation of the rollers; according, therefore, to the rate of the escape of water will the taper or inclined shape of the bar to be produced be determined.

The patentee remarks that, by forming the grooves of the rollers in elliptical shapes, he is enabled, by the gradual rise of one of the rollers, and repetitions of the rolling operation, to produce bars of conical figures. It is sometimes desirable to roll a bar taper or wedge-formed for a portion of its length, and level for the remainder of its length. For this purpose it will be necessary to allow the upper roller to rise to a certain distance only, and then to stop. This may be effected by means of adjusting-screws *k*, *k*, one over each bearing of the rollers, similar to those heretofore used, except that it is through the axes of these adjusting screws, forming guides, that the piston-rods *a*, pass, as shewn at fig. 1; and it will therefore be understood that when, by the escape of the water from the chamber, the bearings of the rollers have been allowed to force up the piston-rod and the piston a certain determined distance, that then the upper edge of the bearing A, of the top roller will come into contact with the under side of the adjusting-screw *k*, beyond which it cannot rise; and as the bearing will, for the time, become fixed, the bar of iron under operation will, for the remaining portion of the process, be rolled parallel. The adjusting-screw *k*, passes through a hollow screw made in a socket fixed in the frame; and the screw can easily be raised or lowered, so as to limit the rise of the bearing A, by merely turning the hand-wheel *l*, attached to its lower part.

It may be as well to observe, that, in order to introduce the sliding bearings of the upper roller into the vertical grooves of the frame, and to remove them when required, a portion of the side of the frame is made removeable, as shewn at *j*, *j*, figs. 1, and 2, and is retained in its place by pins or screws, or in any other convenient known manner. A portion also of the head of the standard in which the piston works is made removeable, for the purpose of getting at the piston and packing when required, as will be seen at *q*, *q*, fig. 3.

Another mode of permitting the shaping-rollers to recede gradually from each other (the use of a piston and column or chamber of non-elastic fluid being, in this instance, dispensed with) is shewn, in sectional elevation, at fig. 5. A vertical sliding-rod *a*, is made to press upon the upper bearing A, corresponding in object to the rod *a*, in fig. 1; and which rod slides through a hollow screw *k*, as before. The upper end of the rod *a*, is not, in this instance, connected to a piston, but merely bears against the under part of a sliding-frame *r*, *r*, which is allowed to rise by the rotary movement of an excentric or heart-formed cam *s*. A pair of rollers as before, or of the ordinary kind, is mounted in the standards; each of which, at their upper ends, carry two bearings *t*, *t*, in which a horizontal shaft *u*, *u*, extending across the top of the machine, is mounted. Upon this shaft are fixed the excentrics or cams *s*, acting within the sliding-frame *r*, *r*, of each standard. The undersides of the sliding-frames *r*, bear respectively upon the upper ends of the vertical rods *a*, which keep down the bearings A, and consequently retain the rollers in contact; and in order to allow the upper roller to rise, for the purpose before described, motion is given to the excentric shaft by sliding the wheel *w*, along the feather or key of the shaft *u*, into gear with the train of wheels connected to a pinion *v*, fixed on the end of the lower roller. Hence it will be seen that, when the shaping-rollers are in motion, the train of wheels will cause the excentrics *s*, to revolve, and thereby, as their smaller radius bears against the bottom of the frames *r*, to allow the frames and the vertical rods *a*, to be forced upwards by the pressure of the mass of metal passing between the rollers.

The patentee claims, Firstly,—the application to rolling-machinery in general (when such is required) of apparatus which will allow the bearings of one of the compressing-rollers to rise gradually in their standards while the operation of rolling is proceeding, and thus to admit of taper forms being produced with the same facility as parallel bars. Secondly,—the construction or arrangement and adaptation of the hydraulic apparatus and its appendages, shewn in figs. 1, 2, 3, and 4, to a machine for rolling iron or other metals, by which the shaping-rollers are enabled to separate gradually, for the purpose of producing taper rods or bars by the rolling process.

Thirdly,—the modification of apparatus shewn at fig. 5, by which an excentric or heart-shaped revolving cam is employed to regulate the gradual progressive separation of the rollers for the purpose above stated. And, Fourthly,—the adjustable screw *k*, figs. 1, 2, and 5, in conjunction with the apparatus claimed under the second and third heads, whereby bars of metal are enabled to be rolled taper for a portion of their length, and parallel for the remaining part thereof.—[*Inrolled June*, 1849].

To HENRY ARCHER, *of Great George-street, Westminster, Gent., for improvements in facilitating the division of sheets or pieces of paper, parchment, or other similar substances.*—[Sealed 23rd November, 1848.]

THE principal object of this invention is to enable persons, when using postage-stamps, tickets, or other small labels, to separate one or more from a sheet, without the employment of a cutting instrument. This improvement the patentee effects by cutting or stamping around the margin of every stamp, ticket, or label, a consecutive series of holes, whereby the tearing up of the sheets of paper or parchment into pieces of uniform size will be greatly facilitated, while there will be sufficient adherence of the several stamps, tickets, or labels, which are printed on one sheet of paper or parchment, to ensure their retaining the form of a sheet, until they are intentionally separated for use.

In Plate VI., several views are shewn of a stamping-press for effecting the stamping process with great expedition. Fig. 1, is a side view; fig. 2, a front view; and fig. 3, a vertical section, taken in the line 1, 2, of fig. 2. *a, a,* is the main framing of the press; and *b, b,* are horizontal bracket-arms, bolted to a cross-bar *a**, of the framing *a*, and provided with V-bars; over which a sliding-frame *c*, traverses. This frame *c*, carries the sheet of paper or other substance intended to be pierced with holes; and for this purpose it is provided, at front and back, with a set of clips or holders *d, d**, for grasping the edges of the sheet;—the jaws of one set of clips *d*, being stationary, as regards their position on the frame *c, c,* and those of the other *d**, being capable of sliding, so as to draw the sheet of paper or other material to a suitable tension to be pierced. The construction of these clips is best shewn at fig. 3. The lower jaw of the moveable set of clips *d**, carries the upper jaw, and a continuation of the lower jaw passes through and slides in a bearing attached to the frame. A coiled spring, surrounding this continuation of the lower jaw of each clip *d**, bears against a nut on the end thereof, and against the piece through which the tail of the jaw slides. The object of this spring is to give the clips a tendency to recede from the clips *d*, at the other end of the frame *c*, and thus to keep the sheet of paper or other substance in tension. On the top of the cross-bar *a**, a slotted plate *e*, is bolted, and over the slot a perforated plate *f*, is fixed. These parts are shewn best in the detached sectional view, fig. 4, which represents the punches, and the parts in connection therewith, on an enlarged scale. The perforated plate *f*, is a matrix, to receive the ends of the punches; the mode of supporting and working which will be understood from the following description:—*g*, is a plate, in which a series of pins are set, in such order of lines as will allow of their circumscribing each stamp of a row of stamps, and punching corresponding holes in the sheet of paper or parchment containing such stamps. The arrangement and fixing of the pins will be better understood on referring to figs. 5, and 6, which shew the parts in connection therewith in sectional elevation and plan view, on a scale corresponding to fig. 4. The matrix-plate *f*, fig. 6, shews the mode of arranging the pins when sheets of British postage-stamps are to be pierced; but it will be obvious that sheets containing round or oval stamps, or stamps or labels of any size or form, may also be pierced with facility, a difference only in the arrangement of the pins and the perforations of the matrix-plate being necessary. *h*, is a metal plate, which carries the plate *g*, with its pins, and is attached to, and forms part of, the plunger *i*. This plunger (see fig. 2,) is provided at its upper part with guides, which work against smooth surfaces of the framing, as is usually employed in such machinery for steadying its movement; and it is jointed to a rod *k*, pendent from a strap-piece, which embraces an excentric *l*. *h**, is a guide, embracing the lower end of the plunger, and intended to ensure the proper action of the punch with respect to the matrix-plate *f*. *m*, is a shaft, having its bearings in the upper part of the frame *a*, and carrying, at about the middle of its length, the excentric *l*. At one end of this shaft a hand-wheel *n*, is keyed, for working the machinery, and at the other end the shaft carries a disc *o*, which has a straight dove-tail slot running across its centre. This slot is intended to receive an adjustable stud-pin of a connecting-rod *p*; the lower end of which is secured by a pin to two arms *q*, *q**, projecting from loose bosses on the short shaft *r*. To the inner end of the shaft *r*, a pinion is keyed, which gears into a rack on the side of the frame *c*, and is intended to drive forward that frame, together with the sheet of paper or other substance which it carries, so as to bring a different part of the sheet under the action of the punches at each descent of the block *i*. This movement is regulated by the following means:—On the shaft *r*, a disc-wheel *s*, is mounted, which is provided, on its periphery, with nicks or indentations, to receive a pawle or catch *t*, suspended from the arm q^*. The boss of the arm *q*, has also an arm q^1; which is connected to the lower end of the catch *t*, by a rod *u*. The upper end of the arm q^*, is slotted, so as to allow of a little play therein of the pin of the connecting-rod *p*. When the rod *p*, is, by the rotation of the disc *o*, depressed, it will force down the arms *q*, q^*, and with them the catch *t*; which, being in a notch of the disc, will drive round that disc, and, consequently, the shaft *r*, together with its pinion, which takes into the rack of the frame *c*; thus the frame *c*, will be moved forward a given distance, proportionate to the excentricity of the pin of the connecting-rod *p*, in the groove of the disc *o*; but on the rising of the rod *p*, by the continued rotation of the disc *o*, the arm *q*, will be raised, and simultaneously the arm q^1, whereby the rod *u*, will be made to lift the catch *t*, out of the notch in the disc *s*; and as soon as the pin which connects the rod *p*, with the arms *q*, q^*, has traversed the slot of the arm q^*, the catch (to which latter arm it is directly attached) will be drawn upwards until it drops into the next succeeding notch, when it is ready to act as before. To ensure the quiescence of the arm q^*, when the pin of the rod *p*, has ceased to act upon it, and is traversing the slot in that arm, a spring friction-piece, attached to the arm q^*, is made to embrace a segmental piece attached to the framing *a*. It will now be understood that when the hand-wheel *n*, is turned, the excentric *l*, will depress the plunger *i*, (which carries the punch) and the paper or other substance beneath will be pierced as required; but immediately before the punch begins to act, the apparatus for bringing forward the paper will have acted as above described, and thus successive rows of the stamps, labels, or tickets, will be pierced at their circumference as required.

The patentee claims the preparation of sheets or pieces of paper, parchment, and other similar substances which contain stamps, tickets, labels, and other analogous impressions upon them, so that they may be divided with facility when the tural tenacious adherence of the fabric, as a whole, is de- oyed (for the above-described object) by either of the erations of piercing, cutting, or stamping.—[*Inrolled May,* 49.]

To WILLIAM EDWARD NEWTON, *of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, civil engineer, for a certain improvement or improvements in the construction of wheels,—being a communication.*—[Sealed 11th January, 1849.]

THIS invention of improvements in the construction of wheels relates to a new or improved method of constructing railroad-wheels, applicable to locomotive engines, tenders, and the truck-wheels of railroad cars, and for other purposes; and consists in constructing the wheel of three principal pieces, namely, the nave, the central part (which consists of plates of iron of a dished shape), and the rim: these three parts are connected and secured together in a peculiar manner, so as to form a strong and, at the same time, cheap wheel.

In Plate V., fig. 1, shews the improved wheel in side elevation; fig. 2, is a transverse section of the same, taken in the line x, x, fig. 1, shewing the mode of holding the several parts together by small screw-bolts near the axle; and fig. 3, is a cross section in the same line, shewing another mode of holding and forcing the central plates together, so as to tighten contact with the rim—in this case the object is effected by a collar and screw upon the axle, and a different mode of attaching the plates to the rim by small bolts or rivets near the rim. Fig. 4. is a cross section, on an enlarged scale, shewing the attachment of the side-plates to the rim, by the dove-tail mode; and figs. 5, and 6, are side and edge views of a cast-iron piece, to thicken and support the eye of the plates when made of sheet-metal. The two circular side-plates, which act as the spokes of the wheel, are made with plain surfaces, or corrugated in concentric or radiating lines; and, whether plain or corrugated, have a convexity outward, so that they may be forced against the rim, which will embrace their exterior edges or peripheries. The best mode of attaching these side-plates to the rim is to turn a groove, commencing at the inner side and edge of the rim, cutting the same outwards towards its largest circumference in depth; the thickness of the plate forming a seat for the same to rest upon, and terminating the groove, in its outward direction, with the largest diameter of cut inside, and the lesser outside, in the form of a dove-tail. The edges of the plates are then turned and fitted to correspond, excepting that the diameter of the plates is greater by about $\frac{3}{16}$ of an inch than the groove that has been turned in the rim. The rim is then sufficiently expanded by heat to admit of the greater diameter of the plates entering into the groove prepared for them in the rim; and, on the rim cooling, it will be made to shrink itself upon the edges of the plates. The side-plates are further secured in their places by screw-bolts near the axle; which bolts are intended to compress and draw together the convex parts of the plates at or near their centres, by which their peripheries are forced to expand until they come into close contact and form a tight joint with the rim. By means also of these bolts or screws the plates may be tightened upon the rim at any subsequent period, when, from use or wear, their contact becomes impaired, or they become loose in the groove. The inventor prefers to construct this wheel of wrought-iron, with the exception of the cast-iron pieces represented at figs. 5, and 6. The rim may, however, be of cast-iron (in which case its thickness should be considerably increased), either with or without a chilled running surface; or it may be made of wrought-iron, plated with steel, or made wholly of steel; and the side-plates may be of cast-iron, or other metal, or composition of metal.

In the drawings A, represents the rim-piece; B, are the side plates; C, is the axle; and D, are cast-iron pieces, to support the plate at the eye, when the same is made of sheet-iron, which pieces are firmly rivetted to the plates. To make a wheel wholly of wrought-iron, the rim A, is rolled into proper shaped bars, in any convenient manner in common use, and is made 5 inches wide by 1 inch thick, with a flange raised 1⅛ inch higher than the bar at one side; it is then bent into a circle and welded; and is heated and placed upon a suitable mandril, and made perfectly round; after which, it is chucked in a lathe, and the male part of the dovetail groove, as seen at *a, a,* fig. 4, is formed at each inner side and corner. The side plates B, are made from plate or sheet-iron, of 5/16 of an inch thick, a little more or less. They are first cut into a circle, and afterwards swaged, and made convex with a suitable press and swaging dies; or the press and dies may be constructed in such a manner as to cut the circle outside the eye at the centre and raise the convexity at the same operation. The plate is then chucked in a lathe, and the edge turned tapering and outwardly towards the convex side, to form the female part of the ultimate dovetail joint, when the plates and rim are put together. The largest diameter of the tapering edge of the plate is made from ⅛ to 3/16 of an inch larger than the smallest inside circumference of the groove. The cast piece (figs. 5, and 6,) is then drilled and tap-screwed, and well rivetted upon the concave side of the plate, when the principal parts of the wheel are ready for putting together. The rim is then heated, and allowed to shrink itself upon the edges of the plates, which by this means are held in the dovetailed grooves formed in the rim,—the convex sides of the plates being outwards: four tap-bolts *c, c,* made of ⅝ round iron, are screwed into and hold the centre of the plates together, and serve to compress the convexity of the plates, expanding their peripheries in such a manner as to tighten up contact at their edges upon the rim, if from any cause they shall at any time afterwards get loose. The above is the best mode;—these side plates B, may however be joined to the rim by turning their edges square and sinking a recess the depth of the thickness of the plate at the inner side and edge of the rim, to fit and correspond with the edges of the plates, when, without expanding the rim, the plates are placed therein; and secured by screw-bolts or rivets, as shewn at *b, b.* The centres of these side plates may be held and forced inwards towards each other by means of a collar *e,* and screw-nuts *d, d,* on the axle.

The patentee claims the forming of a wheel of three principal parts—a rim-piece A, and nave, with two side plates B, B, made with plain or corrugated surfaces, and formed more or less convex outwardly; the whole constructed, put together, fastened, and having tightening screws, as described; and this he claims, whether these principal parts are put together by means of dovetailing the side plates into the rim-piece, as shewn at *a, a, a,* (figs. 2, and 4,) or whether they are attached by means of screw-bolts or rivets passing through the plates near the rim, as shewn at *b, b,* (fig. 3,) or whether the plates are tightened upon the rim by means of screw-bolts placed near the axle, as shewn at *c, c, c,* (figs. 2, and 6,) or by a screw-nut and collar upon the axle, as shewn at *d, d,* and *e,* (fig. 3,) or whether by any other analogous means by which the outward convexity of the plates may be forced inwards or towards each other at or near their centres, thereby causing their peripheries to expand and come into full contact with the rim.—[*Inrolled July,* 1849.]

To JOHN CARTWRIGHT, *of Sheffield, joiner's tool manufacturer, for an improved brace for the use of carpenters and others.*—[Sealed 16th December, 1848.]

IN constructing this improved brace for the use of carpenters and others, certain parts are cast in metal in such manner as to allow of a moveable handle, of horn or other suitable material, being used; the revolving head is also applied in an improved manner; and there is a more convenient arrangement than usual for releasing the bits from the spring-catch in the pad.

In Plate VI., fig. 1, is an elevation of the improved brace; fig. 2, is a vertical section of the same; and fig. 3, is a vertical section of the lower part of the brace, taken at right angles to the section fig. 2. The parts *a, b, c,* form the metal frame or skeleton of the brace; the parts *a, c,* are cast, and are connected together by the spindle *b,* which receives the handle *d,* of horn or other suitable material; and at the lower end of the part *c,* is the pad for receiving the bits. The upper end of the spindle *b,* is square, and is prepared in such manner that, when the part *a,* is cast upon it, the square end will be securely retained in the casting; the lower end of the spindle *b,* on which the part *c,* is cast, is also made square, but is so prepared as to admit of the part *c,* being removed when required; and the spindle is provided with a screw and nut, to hold all the parts together when the brace is complete. The parts *g, g,* which constitute the filling of the frame, may be made of horn, gutta-percha, wood, or other suitable material: if horn or gutta-percha is used, the parts may be accurately formed by pressure in moulds. *h,* is the head of the brace; the lower end of the stem of which enters a bush let into the upper part of the brace; and the parts are combined together in the manner shewn, so that the stem may rotate freely: the patentee prefers to make the head of horn; but other materials may be employed for this purpose. The bits are retained in the pad by a spring-catch, shewn detached, in front and side elevation, at figs. 4; and, in order that the spring-catch may be readily drawn back, when it is desired to remove the bit, the cap or nozzle *i,* (shewn only at fig. 3,) which has a small hole or recess in it, to receive the pin at the lower end of the spring-catch, is so made and attached to the pad that it can be moved laterally.

The patentee does not confine himself to the exact details above described, as the same may be varied. It is not essential that the parts *a,* and *c,* should be cast open; they may be solid, as shewn at fig. 5; and the apparatus for retaining and releasing the bit may be made as heretofore, or as shewn in this figure.

The patentee claims the casting of the parts *a,* and *c,* and connecting them with a stem or spindle *b,* for receiving a separate and moveable handle. Also the mode of constructing and applying the heads, as shewn at figs. 1, 2, and 5. Also the application of horn in the manufacture of heads for braces. Also the mode of acting on the spring-catch by the lateral movement of the nozzle, as described. Also the making of the parts *g*, *g*, of horn or gutta-percha. And also the making of braces with moveable handles of gutta-percha or of horn on spindles *b*.—[*Inrolled June*, 1849.]

To WILLIAM HENRY BARLOW, *of Derby, civil engineer, for improvements in the construction of permanent ways for railways.*—[Sealed 23rd January, 1849.]

THE first part of this invention consists in constructing the wrought-iron rails of railways in such manner that each rail shall form its own bed in the ballast, without requiring the use of chairs, wooden sleepers, longitudinal timbers, stone blocks, or other like expedients, for supporting the same. For this purpose the rails are made of greater width than usual: they may be composed of two or more parts, as shewn in Plate V., at figs. 1, 2, and 3; but the patentee prefers to employ rails of the construction represented at fig. 4. Fig. 5, exhibits a side view of two of the rails applied to form the permanent way of a railway; and fig. 6, is a transverse section of the same. The adjoining ends of the rails *a*, *b*, are connected together by a wrought-iron shoe *c*; and the gauge or distance between the rails is maintained by transverse ties *d*, of wrought-iron, which also serve to give additional bearing surface in the ballast. The shoes are secured to the ends of the rails by wrought-iron bolts and nuts; and the transverse ties are connected to the rails and shoes by similar bolts. The object of the above described arrangement is to dispense with the use of timber in the permanent way, and thereby avoid the cost of renewing the same when decayed.

The second part of this invention consists in a mode of giving support at the joints to the rails commonly used on railways, by the application of a piece or plate of wrought-iron, from a quarter to half an inch thick, and of such form as to fit accurately the side of the rail, in the manner represented at figs. 7, and 8;—fig. 7, being a side elevation of the ends of two rails *a*, *b*, with the supporting plate *c*, applied thereto; and fig. 8, being a transverse section of the same. The plate *c*, should be of such length that it can be keyed into the chairs *d*, *e*, on each side of the joint-chair *f*, as well as into the joint-chair; and it may be keyed against the rail by wooden keys *g*, in the same manner as the rails are commonly keyed into the chairs. The object of this part of the invention is to give increased stiffness to the joints of the permanent way, as at present constructed, and thereby prevent the rocking motion which takes place at the joints, and which is productive of great expense in repairs, and occasions great deterioration of the rails and permanent way.—[*Inrolled July*, 1849.]

To HENRY HEADLEY PARISH, *of Eaton-place, in the county of Middlesex, Esq., for improvements in safety and other lamps, and in gas-burners,—being partly a communication.*—[Sealed 8th February, 1849.]

IN Plate IV., fig. 1, exhibits, in external elevation, and fig. 2, in vertical section, a safety lamp, constructed according to this invention. *a*, is the oil-vessel, which is similar to those in ordinary use, and is provided with a bent wire *b*, for snuffing the wick contained in the wick-tube *c*. The air to support combustion enters through the perforated plate *d*, the wire-gauze cylinder *e*, and the cone *f*, of wire-gauze. *g*, is another cylinder of wire-gauze, containing a strong glass cylinder *h*, the external surface of which is hollowed out or concave; or it may be made of a convex form, as indicated by the dotted lines. *i*, is a glass chimney, which extends upwards through a perforated piece of wire-gauze, and is enclosed within another chimney, consisting of a cylinder of wire-gauze *j*, and a metal cylinder *k*, at the top of which a disc of wire-gauze *l*, is fixed. By this arrangement, not only will the lamp be rendered more safe, but the combustion will be greatly improved.

The patentee subjects the metallic gauze, intended to be used in this or other safety lamps, to the process of electro-deposition, so as to combine all in one; and he prefers that the outer cylinder of wire-gauze, which surrounds the glass in the present lamp, should be electro-coated with silver, as beneficial results are thereby obtained in reflecting the light. The glass, with its cover of wire-gauze coated with silver, and the cylinder of wire-gauze, are applicable to other lamps. Instead of glass, crystal, talc, or any other natural or artificial transparent substance may be used, formed in the same way as the cylinder *h*.

The patentee remarks, with regard to this part of his invention, that, with the exception of the oil-vessel, all the arrangements shewn and described are new and claimed by him.

The improvement in gas-burners, which constitutes the second part of this invention, is shewn at fig. 3. *m*, is an ordinary ring gas-burner; to the under side of the annular portion of which is attached a cone of wire-gauze *n*; and above it a conical ring of wire-gauze *o*, is fixed. *p*, is a deflecting-button. *r*, is the gallery for the glass chimney, which is so formed as to bring the lower edge of the chimney *s*, on a level with the top of the conical ring of wire-gauze *o*. The peculiar novelty of this arrangement is the combining the use of the upper and lower pieces of wire-gauze, by which the atmospheric air will be better applied and the gas better consumed.—[*Inrolled August*, 1849.]

To WILLIAM KNAPTON, *of the City of York, iron-founder, for certain improvements in the mode of manufacturing gasometers or gas-holders.*—[Sealed 3rd January, 1849.]

THIS invention consists in manufacturing gasometers or gas-holders by combining flexible or pliant materials (such as cloth, leather, or other substance, rendered impervious to gas, at ordinary pressures, by being prepared with a solution of India-rubber, vulcanized India-rubber, gutta-percha, or otherwise) with iron plates or other rigid or inflexible materials, so as to enable the gasometers or gas-holders to work without the use of tanks or vats for holding water.

In Plate V., fig. 1, exhibits, in elevation, a gasometer, constructed according to this invention, when full of gas; and fig. 2, is a vertical section of the same, shewing the appearance it presents when nearly empty. *a*, is the upper part of the gasometer, formed of wrought-iron or other suitable metal or material. *b*, is the lower part, formed of cloth, leather, or other suitable flexible material, prepared as aforesaid, and united to the upper part *a*, by wrought-iron hoops and bolts. To the upper part *a*, three chains *c*, are attached, which pass over the pulleys *d*, at the top of the pillars *e*, and are connected to the counterbalance-weights *f*; and the upper part is also provided with guide-rollers *g*, which work against the pillars *e*, as the upper part ascends or descends. *h, h*, are cast-iron columns, for supporting the bottom of the gasometer; and *i, i*, are the supply and discharge pipes for the gas. As the gas is discharged from the gasometer, the upper part will descend, and the flexible portion *b*, will hang below the bottom, in the manner shewn at fig. 2; but, on a fresh supply of gas being introduced, the upper part *a*, will rise until it and the flexible portion *b*, are in the position represented at fig. 1.

This invention also consists in constructing gasometers or gas-holders of four or more parts; two or more parts being rigid, and two or more parts being flexible; and the rigid and flexible parts, which follow each other alternately, being connected together in the manner above described:—by which means a greater depth may be obtained, and a larger quantity of gas stored, without increasing the diameter of the gasometer; for the parts are so made as to enter one within the other when the gasometer is empty.

The patentee does not claim any of the individual parts, nor confine himself to the details shewn and described. He states that his invention consists in manufacturing gasometers or gas-holders by combining flexible and inflexible materials as described.—[*Inrolled July,* 1849.]

To GEORGE FERGUSSON WILSON, *of Belmont, Vauxhall, in the county of Surrey, Gent., and* CHARLES HUMFREY, *of Manor-street, Old Kent-road, in the said county of Surrey, merchant, for improvements in the production of light, by burning oleic acid in lamps, and in the construction of lamps and manufacture or preparation of oleic acid for that purpose.*—[Sealed 28th December, 1848.]

THIS invention consists, firstly, in a mode of constructing lamps to burn oleic acid for the purpose of illumination; and, secondly, in a method of preparing oleic acid for burning in lamps.

Oleic acid is obtained in various ways; but the patentees prefer to use the oleic acid obtained by the improved method of making stearic acid by acidification of fatty matters and subsequent distillation: in all cases they distil or re-distil the oleic acid before using it in lamps. Ordinary oils may be subjected to a very considerable degree of heat without injury; in fact, most of them burn much better in lamps on being well heated before they flow into the wick; while, if oleic acid be exposed to an inferior degree of heat, under like circumstances, it is decomposed, and a black pitchy substance is formed, which prevents it from burning. This will readily be seen if the oleic acid be consumed in a common oil-lamp,—for a short time the combustion will proceed extremely well (the oleic acid naturally burning more freely and brightly than any of the ordinary oils); but, as soon as the burner or burner-tube becomes sufficiently hot to decompose the oleic acid, there is an immediate formation in the wick of the black pitchy substance, which gradually stops the action of the same, and the lamp goes out. The patentees state, that they have found it essential, when burning oleic acid, to cause the burner or tube, containing the cotton wick, to be kept cool, so that the oleic acid may not be subjected to a decomposing heat before it arrives above the burner or tube. It will be observed, after lighting a lamp containing oleic acid, that for a short time the flame remains as shewn in the sectional view Plate VI., where *a*, is the top of the burner-tube, and *b*, the base of the flame; so that there is a small portion of unblacked cotton between the flame and the burner-tube; and as long as this state of things continues, the burner-tube is scarcely heated at all; this, however, soon ceases, and the flame descends until it touches the top of the burner-tube; when the oleic acid, by reason of its great inflammability, quickly inflames (unless some contrivance be applied to the lamp to preserve the non-conducting interval of wick), and the flame almost immediately runs down to the burner-tube, which becomes strongly heated, and the oleic acid is decomposed. The descent of the base of the flame can be prevented by directing a current of air on to the wick, below the base of the flame, and immediately above the top of the burner-tube. For this purpose the plate *c*, is employed, which effectually prevents the descent of the flame and the heating of the burner-tube.

The patentees do not confine themselves to the precise form of lamp shewn, as the same may be varied, so long as the construction be such as to prevent oleic acid from being heated to a decomposing degree until it rises above the burner-tube. As the oleic acid is injurious to brass, which is the metal generally employed for making lamps, it is desirable to plate those parts which are liable to be acted on by it.

It has been usual to employ acid diluted with water as a means of purifying oleic acid, and to apply artificial heat during the process of purification. Now the patentees say they have discovered that heat is prejudicial, and that by simply agitating the oleic acid with diluted acid (they use sulphuric acid), without the addition of artificial heat, the requisite degree of purification is obtained, and in a superior manner.—[*Inrolled June,* 1849.]

To **Rees Reece**, *of London, chemist, for improvements in treating peat and obtaining products therefrom.*—[Sealed 23rd January, 1849.]

This invention consists, firstly, in causing peat to be burned in a furnace by the aid of a blast, so as to obtain inflammable gases and tarry and other products from peat; and, secondly, in obtaining products from peat, termed paraffine and liquid paraffine, by operating on tar or pitchy matter produced from peat.

In Plate IV., fig. 1, is a plan view of two blast-furnaces and apparatus for carrying out the first part of this invention; and fig. 2, is a vertical section of the same. *a, a,* are the blast-furnaces, which are lined with cast-iron at the upper part; *b,* (fig. 1,) is a grating or set of fire-bars; and *c, c,* are the blast-pipes, for introducing a blast of air beneath each grating *b*: the pressure of the blast of air which the patentee employs, is from two pounds to two pounds and a half on the square inch. Each furnace is provided, at the top, with a cover, which is raised when the furnace is to be charged: this is done at intervals, taking care that the charge does not descend so low as to go out. *d, d,* are pipes, leading from the upper part of each furnace, and dipping into water contained in the close trough *e;* and *f,* is a pipe, that connects the close trough *e,* with a series of pipes *g,* which are immersed in the water contained in the trough *h,* and form the condensing apparatus, for condensing the products from the two furnaces. The gases, on their exit from the condensing apparatus, may be collected for use as fuel or otherwise; and the tarry and other liquid products pass into a suitable receiver. The tarry products may be treated according to the second part of this invention; and the other products may be made available for evolving ammonia, wood-spirit, aud other matters, by any of the existing processes. Either hot or cold blast may be employed; but hot blast is preferred to be used when the peat contains much moisture.

The patentee does not confine himself to the blast-furnaces or condensing apparatus above described, as the construction of the same may be varied; nor does he claim the blast-furnace and condensing apparatus separately as new;—the first part of the invention consisting in causing peat to be burned by the aid of blast in a furnace, so as to evolve and collect inflammable gases and tarry and other products from peat.

The second part of the invention consists in obtaining paraffine and liquid paraffine in the following manner:—The patentee takes tar, obtained from peat in the way above described, or by distillation, and, having freed the same from water, he puts it into a still and distils off about half the quantity at as low a temperature as it will come over; he then distils over the residue into a second receiver. The products in the second receiver will consist of paraffine, liquid paraffine, and a small quantity of volatile hydrocarbons. The paraffine is in the state of crystals, which are separated from the liquid paraffine by means of hair or other fine sieves; then the crystals are melted and run into moulds, about two inches deep; and the cakes, thus obtained, are subjected to pressure, in the manner of pressing stearine, in order to separate the more fluid portion therefrom. The hard product is of a dark yellow color; to remove which, it is distilled, the product received into moulds, and the cakes, so produced, subjected to pressure in hot stearine presses,—the heat being kept down to 100° Fahr.: if the first distillation does not remove the color, the process is repeated. After decolorization, the paraffine is melted and washed with water and free steam; and the product is exposed for some days to the action of the atmosphere: this product is suitable for making candles. The liquid paraffine is distilled once or oftener, to remove the color; and it may then be burned in lamps.

The patentee claims, Firstly,—causing peat to be burned in a furnace subjected to a blast, so as to obtain inflammable gases and other products. Secondly,—obtaining products of peat, which he terms paraffine and liquid paraffine, by operating on tar or pitchy matter, produced from peat as above described.—[*Inrolled July,* 1849.]

To John Taylor, *of* 22, *Parliament-street, in the City of Westminster, architect, for an improved mode of constructing and fencing walls.**—[Sealed 8th February, 1849.]

This invention consists in a mode of constructing brick or other walls with a facing of stone, artificial stone, tiles, bricks, cement, earthenware, glass, or other suitable material; the facing being made into blocks of such form that each block may be suspended on the brick or other main work of the wall below, by means of a rebate or shoulder, and weighted by the brick or other work above, without weighting the bed or under surface of the facing-block; so that the same may not be injured by the settling of the brickwork.

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* By a disclaimer, dated 9th April, 1849, the patentee has struck out the words "and fencing" from the title of his patent, which now reads thus:—"an improved mode of constructing walls."

Part of a wall, constructed according to this invention, is represented in Plate IV. *a*, is the brickwork, three courses of which (or a greater or less number, according to the height of the facing-blocks) are first carried up, and the mortar-bed laid; then the facing-block *b*, is suspended thereon by the rebated part or shoulder *c*; and, when the rebate or shoulder is weighted by the continuation of the brickwork, the bonding is complete. As a general rule, the height of the facing-blocks is to be such as to leave their weight suspended on the brickwork by the rebate or shoulder *c*, without the blocks being weighted at the bed or lower surface *d*.

The patentee claims the manner, above described, of combining a facing of stone, artificial stone, tile, brick, cement, earthenware, glass, or other suitable material, with brick or other material in the construction of walls, whereby he is enabled to do with a less quantity of stone or other material than is necessary in the ordinary ashlering,—to bond each facing-block into the brick or other work by throwing the weight of the superstructure upon it, without necessarily weighting the under surface or lower bed of the facing-block, and thus preventing it from flushing off,—and to prevent the evils arising from the unequal settlement of the horizontal mortar-joints, which are more numerous in the brick or other work than in the facing.—[*Inrolled August*, 1849.]

To WAKEFIELD PIM, *of the borough of Kingston-upon-Hull, engine and boiler-maker and builder of iron steam-ships, for certain improvements in propelling ships or vessels.*—[Sealed 25th January, 1849.]

THIS invention relates to the propulsion of vessels by means of screw propellers, and consists in employing, for this purpose, a propeller at the stem or fore part of the vessel, acting in addition to, and in combination with, the propeller at the stern or hind part of the vessel. The propellers work in recesses formed to receive them in the stem and in the dead wood of the vessel; and they are fixed upon the same shaft, which extends from one end of the vessel to the other, pa-
llel with the keel; or they may be fixed upon two distinct
s, connected by gearing, so that both will rotate in the
direction and act, the one to impel, and the other to
forward, the vessel.

In concluding his specification (which is necessarily a very short document), the patentee states that his invention consists in a combination of two or more instruments, having blades adapted for moving a vessel through the water by simultaneous action at the stem and stern, as above described.—[*Inrolled July,* 1849.]

To Ewald Riepe, *of Finsbury-square, in the county of Middlesex, merchant, for improvements in the manufacture of soap,—being partly a communication.*—[Sealed 30th January, 1849.]

This invention consists in a mode of applying carbonated alkali in the manufacture of soap.

The patentee first makes a saponaceous glue with caustic alkaline lye, and completes the saponification by the use of stronger caustic alkaline lye. To this saponaceous compound he adds pure or nearly pure carbonated alkali, in such quantity that the real alkali contained in it shall be equal to half the real alkali contained in the caustic alkaline lye; but these proportions may be varied. He uses the carbonated alkali in the dry or calcined state, and adds it to the saponaceous compound when the latter is in such a state of concentration that, on a portion of it being taken up by means of a trowel or palette knife, it will fall therefrom in clotted lumps. The carbonated alkali will become dissolved as the saponaceous compound boils up; and, when it is dissolved, the process is complete; and the soap is to be cleansed or completed in the ordinary way.

The patentee claims, as his invention, the combination of carbonated alkali, as above set forth, in the manufacture of soap.—[*Inrolled July,* 1849.]

To John Talbot Tyler, *of the firm of Ashmead and Tyler, Mount-street, Grosvenor-square, hatters, for certain improvements in hats, caps, and hat-cases.*—[Sealed 25th January, 1849.]

The first part of this invention relates to the manufacture of hats, and consists in making them with a more curvilineal crown than usual, and of such an articulate or jointed structure, both in the crown and brim, that they can readily be folded flat, and expanded again into their original shape, but always in the same fixed lines.

In Plate V., fig. 1, is a front view, and fig. 2, a side view of one of the improved hats. The shape given to the crown somewhat resembles that of a helmet: the advantages resulting from this shape are stated to be, that it is free at the front and back from the angular edges common to all cylindrical and conical hat crowns with flat tops, and therefore less liable to unequal wear and injurious collisions. In order to construct the hat so that it shall fold in those lines only which are most suitable for the purpose, the patentee proceeds in the following manner (technically termed "forming the crose"):—If the fabric is felt or beaver, either the stiffening composition is not applied to the parts where the folds or "croses" (indicated by *a, a,* fig. 1,) are to be, or the stiffening composition is removed from these parts by the application of a hot solution of salts of tartar, borax, or some other chemical equivalent, which will discharge the shellac employed for stiffening, and leave these parts soft and yielding. The napping is now put on the body; then it is blocked in the form required; and after this it is dyed and finished. As the brim of the hat would be very weak at the front and back, by reason of the three unstiffened parts or croses *b, c, d,* which converge towards and meet at these points, the patentee prefers to stiffen the whole of the brim, with the exception of the crose *b*; then he cuts through the brim obliquely in the lines *c, d,* meeting in a point with *b*; and he edges each of the side joints *c, d,* with a strip of whalebone, metal, or other rigid material, covered with silk. The joints or croses are formed in plated or silk hats by cutting through the body in the lines of the intended folds, and connecting the edges by laying over and cementing to them a thin strip of India-rubber or other suitable material;—the strip being applied in such manner as to leave the edges a small distance apart, in order that they may not rub against or cut through the strip when the hat is folded.

The second part of this invention relates to the manufacture of felt caps, and consists in forming them on the same block as the hats, and of one single piece, articulated or jointed to suit any desired form, and to fold up flat when required.

Figs. 3, and 4, exhibit two caps, made according to this part of the invention. The caps may be of the same helmet form as the hats, or of any other shape that may be preferred. The articulating or jointing is produced by omitting or discharging the stiffening composition from those parts where the folds are to be, in the manner described above with regard to hats.

The last part of the invention relates to travelling hat-cases of a square or oblong form only. In these cases there is always considerable space unoccupied beneath and around the hat; and the improvements consist in turning such vacant space to useful account, by forming repositories, for articles required in travelling, in the sides, bottom, and top of the case, without materially increasing its general size.

Fig. 5, is a vertical section of one of the improved hat-cases; and fig. 6, is a plan view of the same in an open state, the hat-tray being removed. *e*, is the outer case, made of leather, gutta-percha, or other suitable material; and *f*, is the inner case, resting on a false bottom *g*, between which and the bottom of the outer case there is a space, forming a secret recess for papers and other articles of value. The inner case is secured to the outer by bolts at *h*, *h*, which are concealed from view by flaps or pieces of leather; so that, in order to get at the secret recess, it will be necessary to unfasten the bolts and lift the inner case out of the other case *e*. The inner case is divided internally into a central compartment *i*, to receive the crown of the hat,—three open spaces *k*, *k*,—and two side compartments for holding boxes *l*, *l*, which are provided with lids, and can be removed at pleasure. *m*, is a tray, similar in form to a hat (except that the upper part m^1, is square instead of being round), which, after the hat has been put into its place, fits into and over the same: it is furnished with small projecting pieces of metal, which rest on the upper edge of the outer case, so as to prevent the tray from resting upon or crushing the hat beneath; and the central portion of the tray is provided with a lid. There is a space left between the back parts of the inner and outer cases for holding a portfolio *n*. The lid e^1, of the case is hollow, and has a separate lid *o*, secured by a bolt *p*.

The patentee claims, Firstly,—making hats of the helmet form, whether folding or not, as above described. Secondly,—making every description of hats with folding joints or articulations, as above described. Thirdly,—making caps in one piece, with joints or articulations similar to the hats, as above described. Fourthly,—the hat-case, in the new arrangement and combination of parts of which the same consists, as above described.—[*Inrolled July*, 1849.]

To CHARLES WILLIAM KESSELMEYER, *of Manchester, warehouseman, and* THOMAS MELLODEW, *of Oldham, manufacturer, for certain improvements in the manufacture of velvets, velveteens, and other similar fabrics.*—[Sealed 2nd November, 1848.]

THIS invention relates to the production of fabrics commonly known as cotton tabby velvets, cotton Genoa velvets, and cotton velveteens. In the manufacture and finishing of cotton velvets it has invariably been a point of the greatest importance to produce an article as much as possible resembling silk velvet. In order to attain this end various means have been resorted to, which have not answered the required purpose, inasmuch as the plush or pile of a silk velvet is much deeper than that which has hitherto been produced in cotton velvets,—thereby giving the cotton velvet a flat and thin appearance without richness of color when compared with silk velvet. To remedy this defect, cotton velvets have been made in a coarser "reed;" but the fabric is thereby rendered so coarse and heavy as to be unlike the fine texture of a silk velvet.

Before describing the method whereby they obtain a great depth of pile, the patentees, in order to shew more clearly the peculiarity of their invention, make the following preliminary remarks:—Cotton velvets and velveteens, as hitherto manufactured, have consisted of combinations of six warp-threads with weft-threads; and such fabrics, as hitherto manufactured and finished, have been ordinarily distinguished as "tabby" or plain back cotton velvets, and "Genoa" or three-leaf twilled back cotton velvets and velveteens. Such fabrics, in order to allow of their being cut or ploughed up, must consist of a close and firm back, in the formation of which every warp-thread is employed. Into every alternate warp-thread of this back there are interwoven weft-threads, which float on the face and form a surface; between which and the back a cutter's guide and knife can be introduced, so as to cut open the floating weft-threads, which afterwards form the plush or pile of the cotton velvet.

The constitution of cotton velvets, as hitherto manufactured, will best be understood by reference to Plate VI.;—fig. 1, being a section of uncut cotton velvet, magnified, shewing the manner in which the weft-threads, which form the face or pile of the old make of cotton velvet, are interwoven with the warp-threads; and from which it will be seen that every float or weft-thread always extends over five warp-threads, and is bound into the sixth; and that three different floats or weft-threads are interwoven with the warp-threads, the first being repeated after the third; after which, the repetition of the second and third follow, and so on in regular succession; thus presenting a combination of six warp-threads with the weft-threads. The manner in which this interweaving is carried out in the loom is well understood amongst persons engaged in this manufacture.

Now the present invention consists in manufacturing the above description of fabrics by means of combinations of eight, nine, or more warp-threads with weft-threads; thereby producing a deeper pile, with a finer or more silky surface than was produced by the combination of six warp-threads with weft-threads, from the same reed, warp, and weft; the back of the fabric still remaining either plain or tabby, or three-leaf twilled or Genoa. The warp is prepared in the same manner as for the old make, as far as dressing or sizing and winding on the yarn-beam are concerned; but, instead of drawing it into a set of healds, consisting of six shafts, a greater number of shafts and healds (according to the greater depth of the pile intended to be produced) are employed. For the production of fabrics consisting of a combination of eight warp-threads with weft-threads, healds consisting of eight shafts are employed, each shaft containing individual healds or loops to the amount of one-eighth part of the whole number of warp-threads on the yarn-beam. The drawing-in into the healds and reed is carried on from the left side to the right for power looms, in the same regular manner across the whole of the shafts as in the manufacture of cotton velvets. Instead of employing eight shafts for producing the combination of eight warp-threads with the weft-threads, the same may be produced by using only seven, six, or even five shafts; the drawing-in of the warp-threads into the healds will, however, in this case, not be a straight "gait-over," but will vary in different ways, according to the number of shafts intended to be employed in the manufacture, as is well understood by practical weavers. The weaver's draft for manufacturing cotton tabby velvets, of a combination of eight warp-threads with weft-threads, is given at fig. 11, where it will be found that, in employing eight shafts and a straight gait-over drawing-in, the second, fourth, sixth, and eighth shafts, are, by the revolutions of the tappet, always either raised or lowered exactly at the same time and in the same manner; and, consequently, the warp-threads which are drawn in into the healds or loop-holes on these shafts are always lying in exactly the same position during the process of weaving, being either raised or lowered together at the same time and in the same manner. It is therefore possible, by having the healds or loop-holes, which are spread or knit over these four shafts, all mounted or knit on one shaft to produce exactly the same result; in which case this one shaft must contain four times as many healds or loop-holes as any one of the remaining four shafts, or exactly one half of the whole number of warp-threads. Or else the healds or loop-holes on the second, fourth, sixth, and eighth shafts may be knit on two shafts, each shaft containing double the number of healds or loop-holes as any one of the remaining four shafts; or else on two shafts, of which one contains the same number of healds, and the second three times the number of healds, knit on any one of the other four shafts; in which case the same fabric can be produced by using six shafts. In the same manner seven shafts may be employed, by uniting the healds or loop-holes of two shafts out of the four which have been named; this one shaft containing, in this case, double the number of healds or loop-holes of any one of the remaining six. Now, all these various ways will produce the same result; but the drawing-in into the healds must be varied to suit the number of shafts employed.

The patentees state that, although they have described the manner of drawing-in into the healds and reed (the former of which are knit or attached to shafts) which they consider the most convenient, they do not consider it indispensably necessary to employ any shafts at all in the process; for the warp-threads may be raised or lowered by various other methods; as, for instance, by means of Jacquard machines and other similar contrivances; but, in whatever way it is done, the warp-threads must follow each other in the same manner as already laid down; and the sheds likewise must follow each other in the same manner, as will presently be shewn,—whatever contrivances may be used for raising or lowering the warp-threads, and thus producing the successive sheds.

The drawing-in of the warp on the yarn-beam into the healds and reed being completed, the whole are put into the loom and tightened up for work, in the same manner as at present practised in the manufacture of cotton velvets. The number of pairs of jacks and treadles and tappet-plates required must always be the same as the number of shafts employed in drawing-in; as one pair of jacks, and one treadle, and one tappet-plate are always wanted, in order to raise or lower one shaft by the revolving motion of the tappet. Each of the eight tappet-plates used for weaving the improved cotton tabby velvets (shewn by diagram in the drawings), will have to be divided into ten parts, or consist of ten divisions, each part having a "riser" or "sinker" cast on, by means of which the shafts are either raised or lowered, as may be required; so that, after a succession of ten sheds, the gait-over of the weft-threads, which are thrown into the sheds of the warp-threads by the shuttle, will be complete; and all succeeding sheds will be mere repetitions of the first ten, being produced exactly in the same manner.

The cotton tabby velvet, now under description, is shewn at figs. 3, and 4; and the manner in which the sheds will have to follow each other will be understood on inspecting fig. 11. 1st.—The first shed is opened out by raising the first, third, fifth, and seventh shafts, and lowering the second, fourth, sixth, and eighth; into which shed a weft-thread is thrown by the shuttle, which thus interweaves the whole of the warp-threads with each other: this first weft-thread is a binder or back-pick, and merely serves to form the back of the cloth, and does not at all enter into the production of the face intended for the plush or pile. 2nd.—The second shed is opened out by raising only the first shaft and lowering all the rest, namely, the second, third, fourth, fifth, sixth, seventh, and eighth; into which shed a weft-thread (represented by the shaded line *a*, fig. 3,) is thrown by the shuttle, which thus interweaves with every eighth warp-thread, namely, the first, ninth, seventeenth, and so on, across the whole width of the piece,—while this same weft-thread floats over the second, third, fourth, fifth, sixth, seventh, and eighth warp-threads of every gait-over: this second weft-thread is a weft-float or face-pick, being altogether used for the formation of the face of the cloth intended to be cut open, in order to produce the plush or pile. 3rd.—The third shed is opened out by raising only the fifth shaft and lowering all the rest, namely, the first, second, third, fourth, sixth, seventh, and eighth; into which shed a weft-thread *c*, is thrown by the shuttle, which thus interweaves only with every eighth warp-thread, namely, with the fifth, thirteenth, twenty-first, and so on, across the whole width of the piece,—while this same weft-thread floats over the first, second, third, fourth, sixth, seventh, and eighth warp-threads of every gait-over: this face-pick is likewise altogether used for the formation of the face of the cloth intended to be cut open, in order to produce the plush or pile. 4th.—The fourth shed is opened out by raising only the third shaft and lowering all the rest, namely, the first, second, fourth, fifth, sixth, seventh, and eighth; into which shed a weft-thread *b*, is thrown by the shuttle, which forms again a weft-float or face-pick, interweaving only with every eighth warp-thread, namely, the third, eleventh, nineteenth, and so on, across the whole width of the piece,—whilst this same weft-thread floats over the first, second, fourth, fifth, sixth, seventh, and eighth warp-threads of every gait-over: this face-pick is likewise altogether used for the formation of the face of the cloth intended to be cut open, in order to produce the plush or pile. 5th.—The fifth shed is opened out by raising only the seventh shaft and lowering all the rest, namely, the first, second, third, fourth, fifth, sixth, and eighth; into which shed a weft-thread *f*, is thrown by the shuttle, which forms again a weft-float or face-pick, interweaving only with every eighth warp-thread, namely, with the seventh, fifteenth, twenty-third, and so on, across the whole width of the piece,—whilst the same weft-thread floats over the first, second, third, fourth, fifth, sixth, and eighth warp-threads of every gait-over: this face-pick is likewise altogether used for the formation of the face of the cloth intended to be cut open, in order to produce the plush or pile. 6th.—The sixth shed is opened out by raising the second, fourth, sixth, and eighth shafts and lowering the first, third, fifth, and seventh, and is therefore just the reverse of the first shed; into this sixth shed a weft-thread is thrown by the shuttle, which thus interweaves the whole of the warp-threads with each other, and therefore constitutes a binder or back-pick, as it merely serves to form the back of the cloth, and does not at all enter into the production of the face intended for the plush or pile. The sixth shed being exactly the reverse of the first shed, these two back-picks, in the first and sixth sheds, so completely interweave the whole of the warp-threads with each other, that not one of them across the whole width of the piece remains loose or unoccupied;—thus forming the close and firm back which is necessary for the production of a tabby cotton velvet. 7th.—The seventh shed is opened out by raising only the first shaft and lowering all the rest, namely, the second, third, fourth, fifth, sixth, seventh, and eighth; it is therefore in every respect equal to the second shed, and thus produces a weft-float or face-pick, bound into every eighth warp-thread, namely, into the first, ninth, seventeenth, and so on across the whole width of the piece, exactly the same as the first weft-float in the second shed. 8th.—The eighth shed is opened out by raising only the fifth shaft and lowering all the rest, namely, the first, second, third, fourth, sixth, seventh, and eighth; it is therefore in every respect equal to the third shed, and thus produces a weft-float or face-pick, bound into every eighth warp-thread, namely, into the fifth, thirteenth, twenty-first, and so on across the whole width of the piece, exactly the same as the second weft-float in the third shed. 9th:—The ninth shed is opened out by raising only the third shaft and lowering all the rest, namely, the first, second, fourth, fifth, sixth, seventh, and eighth; it is therefore in every respect equal to the fourth shed, and thus produces a weft-float or face-pick, bound into every eighth warp-thread, namely, into the third, eleventh, nineteenth, and so on across the whole width of the piece, exactly the same as the third weft-float in the fourth shed. 10th.—The tenth shed is opened out by raising only the seventh shaft and lowering all the rest, namely, the first, second, third, fourth, fifth, sixth, and eighth; it is therefore in every respect equal to the fifth shed, and thus produces a weft-float or face-pick, bound into every eighth warp-thread, namely, into the seventh, fifteenth, twenty-third, and so on across the whole width of the piece, exactly the same as the fourth weft-float in the fifth shed. All succeeding sheds are mere repetitions of the preceding ten; so that the proper pattern for weaving the improved cotton tabby velvet, just described, consists of a combination of eight warp-threads interwoven with ten weft-threads, as will be seen by referring to figs. 9, 10, and 11; of which fig. 9, shews the mode of forming the back of this improved cotton tabby velvet, leaving out the weft-floats or face-picks; fiig. 10, shews the formation of the face of the same, leaving out the binders or back-picks; and fig. 11, the combination of both the preceding,—thus constituting the weaver's draft for weaving the improved cotton tabby velvet shewn at figs. 3, and 4. It will be seen, by examining these figures, that, for every back-pick or binder, four different and distinct weft-floats or face-picks are introduced; and that each of the weft-floats or face-picks, in every instance, is floating over seven warp-threads, in the combination of eight warp-threads with weft-threads.

Although the above described method of carrying out the invention is preferred, it will be obvious that various alterations may be adopted, either in the way in which the different and distinct weft-floats follow each other in succession, or in the manner in which they are interwoven with the warp-threads. The improved cotton tabby velvet, having been woven, must now be cut; for this purpose, the cutter's knife and guide, hitherto usually employed in the manufacture of cotton velvets, will require some alteration. As a general rule, it may be stated that a narrow and rather high guide, which has a tendency to lift up the weft-floats, and thus to keep them tight before the knife divides them, is the best adapted for the purpose. The cutting, which is parallel with the warp-threads, as in the old cotton tabby velvets, is begun at the far side of the piece; and, by referring to fig. 3, there will be seen four different and distinct races, just above the warp-threads 1, 3, 5, and 7; into which races the cutter's guide and knife is introduced. In cutting the first race, three out of every four weft-floats are cut open, viz., the lines *b*, *c*, and *f*; the fourth line *a*, being bound round the back of the warp-thread, on which the cutter's guide is running; so that this fourth weft-float cannot be cut at the same time. It will also be observed that, when the cutter proceeds to introduce his guide into the second race, he has only one weft-float out of every four left to cut open, namely, the line *a*, which is the one that was left uncut when the knife and guide were running in the first race; the second weft-float or line *b*, being bound round the back of the warp-thread, on which the guide is running as before stated, cannot be cut open; and the third and fourth weft-floats *c*, and *f*, having already been cut open at the time when the first race was cut, are lifted up or opened by the guide and knife when running down the second race. Every succeeding race will resemble the second, as in every one the knife will only cut open one-fourth part of the weft-floats in the race, and open out two other fourth parts; while the last fourth part lies at the back of the cloth, and therefore cannot be cut. It being important that the pile should have a level surface, the weft-floats should be cut exactly in the middle between the warp-threads by which they are bound in; to accomplish which, the cutter must hold the guide and knife in a slanting direction towards himself during the process of cutting, so as to cut the weft-floats, not on the top of the warp-thread on which the guide is running, but on the top of the second warp-thread, which lies nearer to himself: by this means, the weft-floats may be divided exactly in the middle—whereby a level and solid surface of pile will be produced. The depth of the pile in this description of improved cotton tabby velvets, when properly cut, is therefore equal to the thickness and distance of three and a half warp-threads, or two-fifths deeper than the pile of the old make of cotton tabby velvets, if made in the same reed as shewn in proportion at fig. 4, which represents this description of improved cotton tabby velvet in section, with the pile cut open.

In combining ten warp-threads with the weft-threads, to make an improved tabby velvet, each face-pick extends or floats over nine warp-threads, thus forming a proportionably longer pile when cut open, as shewn at figs. 5, and 6. For this manufacture of cotton tabby velvets the patentees use ten shafts, each containing individual healds or loop-holes to the amount of one-tenth part of the whole number of warp-threads on the yarn-beam, though it is not exactly necessary that ten shafts should be employed. If made with ten shafts, the drawing-in into the healds and reed is carried on in a straight gait-over across all ten shafts, similar to the last-described mode,—the gait-over consisting of ten warp-threads instead of eight. The manner of weaving this fabric will be readily understood by the practical weaver, on referring to fig. 12; from which, as also from figs. 5, and 6, it will be seen, that for every back-pick or binder five different and distinct weft-floats or face-picks are introduced into the manufacture, and that each of the weft-floats or face-picks is, in every instance, floating over nine warp-threads. In weaving this improved fabric, various alterations may be introduced, either in the way in which the different and distinct weft-floats follow each other in succession, or in the manner in which they are interwoven with the warp-threads, similar to those which have already been stated, when describing the combination of eight warp-threads with the weft-threads. The cutting of this description of improved cotton tabby velvets is done nearly in the same manner as already described; but it will be obvious, that as the weft-floats increase in length the cutters, guide, and knife will have to be adapted to the new manufacture by the adoption of a still higher guide. In introducing the guide and knife into the first race of the velvet, the workman cuts open four out of every five weft-floats; and in every succeeding race he cuts open one weft-float, and opens out three of the five weft-floats, leaving the fifth uncut, it being always bound round the back of the warp-thread on which the guide is running, as will easily be understood by referring to fig. 5, in connection with what has been already stated in reference to this subject. The guide and knife must again be held in a slanting direction towards the cutter, so as to divide each weft-float exactly in the middle. The depth of the pile, in this description of improved cotton tabby velvet, is equal to the thickness and distance of four and a half warp-threads, or four-fifths deeper than the pile of the old cotton tabby velvet, if made in the same reed as shewn at fig. 6.

If a still deeper pile be required, it can be produced by a combination of twelve warp-threads with the weft-threads, as exhibited in relative proportion at fig. 7, uncut, and at fig. 8, after having been cut open: this latter figure also represents a Genoa or three-leaf twill back, from which it will be seen, in connection with what has before been stated, that the depth of the pile of this description of improved cotton tabby velvet is equal to the thickness and distance of five and a half warp-threads, or one and one-fifth part deeper than the pile of the old cotton tabby velvet, if made in the same reed.

The various details already stated, in reference to the combination of eight and ten warp-threads with the weft-threads, will apply to this or any other combination of warp-threads with weft-threads for the purpose of producing the improvements in velvets, velveteens, and similar fabrics. For the use of the practical weaver it will be found sufficient here to refer to the weaver's draft, fig. 13; from which it will be seen that each of the weft-floats or face-picks, in every instance, is floating over eleven warp-threads. If the surface of any of the improved fabrics should not be quite level, on account of defective cutting, the piece may go through a shearing machine, which will shear down the fibres which are too long to the length of the shorter ones, and thus produce a level surface. Many variations may be adopted in the manner in which the warp-threads and weft-threads are laid together, such as binding in the weft-floats with one, two, three, or more warp-threads, so as to produce similar fabrics; also combinations of a greater number of warp-threads with the weft-threads may be formed, whereby a deeper pile may be produced than by any of those above described.

The difference between cotton Genoa velvets and cotton tabby velvets consists mainly in the formation of the back of the cloth, which, in the cotton tabby velvets, is plain or tabby; while, in cotton Genoa velvets, it is three-leaf twilled; it therefore is obvious that the combinations of eight, nine, or more warp-threads with the weft-threads may be employed as well in connection with a three-leaf twill back as with a tabby or plain back, and will only differ in the manner in which the back of the fabric is formed, as will be well understood by practical weavers. By substituting a three-leaf twill back for a tabby or plain back, the improved cotton Genoa velvets are produced with a pile varying in depth according to the number of warp-threads over which the weft-threads or face-picks are made to float. The practical weaver is referred to the weaver's drafts, figs. 14, 15, and 16, from which the manner of drawing-in and weaving will be easily perceived.

Cotton velveteens likewise consist of a three-leaf twill back, into which the weft-floats or face-picks are interwoven, in the same manner as in weaving a cotton Genoa velvet; and the present improvements are therefore equally applicable to cotton velveteens as to cotton Genoa velvets, and are carried out in the same manner,—the weaver's drafts, figs. 14, 15, and 16, being also those for drawing-in and weaving cotton velveteens, which are made in a coarser reed, and of coarser warp and weft than cotton Genoa velvets.

The increased depth of the pile in the improved velvets causes it to absorb much more than the ordinary amount of coloring matter during the process of dyeing, whereby a peculiar richness, fullness, or depth of color, is obtained, which therefore contributes to the attainment of the patentees' object, viz., to produce a cotton velvet or velveteen as near as possible resembling silk velvet or silk plush. A similar result will also be obtained by using linen or flax, or a mixture of linen or flax and cotton, in the manufacture of fabrics according to this invention.

The patentees claim the manufacture of velvets, velveteens, or other similar fabrics, of cotton, linen, or flax; such fabrics consisting of combinations of eight, nine, or more warp-threads, interwoven with the weft-threads, as above described. —[*Inrolled May*, 1849.]

To John Browne, *late of Bond-street, now of Great Portland-street, in the county of Middlesex, Gent., for improvements in constructing and rigging vessels; and improvements in atmospheric and other railways.*—[Sealed 6th February, 1849.]

This invention is divided into three parts: it relates to a "wheel-rigged ship," an atmospheric railway, and a balloon railway.

That part of the invention which relates to the wheel-rigged ship is thus described by the patentee:—"The characteristic of the wheel-rigged ship is, that, supposing that there are six masts, more or less, with their sails, that, by means of a long bar of iron, or other material (I prefer the wire-rope), to which these sails are attached, that, by means of a wheel or wheels, the whole of these sails attached may be made to work round at once: for the sake of conveniently working at will I have these sails in frames. The frames can be thus made to work round by means of the wheel; or the sails, instead of being reefed, as at present, when found necessary to shorten sail, they can, by means of a rope, be pulled one side, and drawn together or pulled out at pleasure. There may be one line of six masts, more or less, or two lines of six masts, with their sails, more or less; there may be likewise one or more lines of masts above, to answer as top sails or top-gallant sails; they may be constructed and worked in the same manner by the wheel. There may be one or more keels, or one broad one doing the duty of two. In having two rows of masts the projector relies upon the pressure of the windward sails counteracting the pressure on the leeward sails. The pressure on the windward side of the keel would act as a counterbalance to the pressure on the leeward side of the keel, and tend to steady the ship. I should propose for the wheel-rigged ship to be built in shape, either as the hulls of ships are at present, or to have the hulls of the wheel-rigged ship, as well as other ships, a broad head with a sharp snout, and from the head to the stern to diminish gradually; by which, I suppose, a more general tendency would arise to be impelled forward."

The improvement in atmospheric railways consists in an arrangement of parts to be used instead of the ordinary longitudinal valve. Over the longitudinal opening of the traction-tube, two plates of iron, tin, or other suitable substance, are placed; and these plates are pressed together by the action of a succession of springs, which press upon a slight board, and this board presses on the iron plates. The iron plates are retained in their proper positions by being surrounded with leather, which is faced with gutta-percha, on account of the friction it will have to undergo. Above or below this "range" there is a long strip of gutta-percha, or other suitable substance, intended to act in the same manner, and to effect the same object, as the iron plates (*i.e.* closing the longitudinal opening of the traction-tube air-tight), being covered with leather and pressed upon in the same manner by a thin board, which is acted on by a succession of springs.

The last part of this invention is termed the balloon railway, and has for its object to convey passengers from one place to another in the car of a balloon, which is constantly retained at a small altitude above the surface of the earth, and is guided in its course by being connected, by a cord, rope, or other suitable means, with a small carriage or "holder," which travels along a railway or rail fixed upon the ground—such holder being suitably constructed for conveying a person, whose duty is to clear the rail from any impediments. The patentee states that the railway may be constructed in various ways. He proposes first to lay down a line of heavy planks, with cross planks where necessary. The rail, which may be made of iron or other suitable material, need not be more than one foot high; it should have a projecting piece at the top, against the under side of which the wheels of the holder are to travel; and the rail may be fastened to a board, and this board fastened down upon the line of planks already laid down. In crossing lakes, marshes, or rivers, the line may be carried under water, or float upon the water, or be supported by bridges or arches. Sails may be attached to the balloon or holder. The car of the balloon is made more extensive or larger than those hitherto in use; and it has a hole in the bottom, through which the line or rope that connects it with the holder passes—this line, the patentee says, may, perhaps, not exceed 100 feet in length.—[*Inrolled August* 1849.]

To JEAN ADOLPHE CARTERON, *now of Paris, in the Republic of France, but late of the Haymarket, in the county of Middlesex, England, chemist, for certain improvements in dyeing.*—[Sealed 5th February, 1849.]

THESE improvements in dyeing consist in the preparation of certain mordants, to be used instead of the cream of tartar and cream of tartar and alum now commonly employed, whereby colors will be produced at less cost than heretofore, and of superior brilliancy and variety.

The mordants are four in number. The first is prepared by dissolving eighteen parts of common salt and nine parts of tartaric acid in sixty-seven parts of boiling water, and then adding eighteen parts of the acetic acid of commerce. One pound of this mordant is equivalent, for dyeing purposes, to about one pound of cream of tartar; and it is used in the same manner. It is suitable for crimson and all reddish dyes.

The second mordant is made by triturating and mixing one part of alum with two parts of the residuum (sulphate of soda) of that mode of manufacturing nitric acid in which nitrate of soda is employed. Two pounds and a quarter of this mordant are equivalent to half that quantity of cream of tartar; and it is to be used in the same way. It is suitable for all olive and brown dyes.

The third mordant is prepared by triturating and mixing together five parts of common salt and one part of the residuum of the manufacture of sulphuric acid where nitrate of potass is employed. This mordant is to be used in the same proportions to cream of tartar as the second mordant; and it is applicable to black and dark colors only.

The fourth mordant is formed by dissolving six parts of sulphate of alumina, three parts of nitric acid, and one part of caustic lye of 24° Beaumé in twenty quarts of boiling water. It may be used in dyers' baths for green dyes of all shades and fancy dyes, in the proportion of one pint for every twenty pounds weight of the fabrics to be dyed.

The patentee states that wherever the word "parts" occur in his specification he means parts by weight.

He claims, as his improvements in dyeing, the four mordants above described, each in the peculiar combination of materials of which it is composed, and the mode of compounding the same.—[*Inrolled August,* 1849.]

To HUGH LEE PATTINSON, *of Washington House, Gateshead, in the county of Durham, chemical manufacturer, for improvements in manufacturing a certain compound or certain compounds of lead, and the application of a certain compound or certain compounds of lead to various useful purposes.*—[Sealed 14th February, 1849.]

THE patentee commences his specification by stating that he has discovered that when half an equivalent or thereabouts of lime, soda, potash, ammonia, or barytes, is added to one equivalent of chloride of lead, both in solution, the whole of the lead is precipitated as a definite compound of one atom of chloride of lead and one atom of hydrated oxide of lead, which, when dried at 212° Fahr., or under, has the composition just stated or $PbCl+PbO{\cdot}HO$, but when dried at a temperature varying from 212° to 350° it loses more or less of the atom of water and becomes or approaches to $PbCl+PbO$. If less than half an equivalent of the alkaline precipitant is employed, the same definite oxichloride of lead is precipitated, but some of the chloride of lead remains in solution. The oxichloride of lead, thus produced, possesses a brilliant white color and great "body" qualities, which render it an excellent pigment and useful for most purposes to which white lead is applicable.

The invention consists in the manufacture and application of this oxichloride of lead, or such other compounds of oxide of lead and chloride of lead as shall result from the following mode of manufacture:—The patentee states that lime will answer as well for the purposes of this invention as any of the other alkaline precipitants above named; and he prefers to use it, on account of its cheapness. He first makes a saturated lime water, by throwing an excess of slaked lime into a tub, filling the tub with water, and allowing it to stand until it becomes clear: the clear liquor will contain in from 770 to 780 parts, 1 part of lime; and therefore 1 cubic foot of it will contain 567 or 568 grains of lime. A solution of chloride of lead is then made by dissolving it in boiling water, in the proportion of one pound of pure chloride of lead to one cubic foot and a fifth of water: as some water contains earthy salts (sulphates or carbonates, or both) which precipitate lead, the patentee prefers to use such an excess of chloride of lead as will compensate for this loss. The solution is prepared by introducing the chloride of lead and boiling water into a wooden barrel, provided with a revolving agitator; and then it is run into cisterns to settle. The clear solution of chloride of lead is mixed, while still warm (because if allowed to become cool it would deposit some of the chloride of lead), with an equal bulk of the lime water; on this taking place, the insoluble oxichloride of lead is immediately formed and speedily settles to the bottom of the cistern, leaving a clear supernatant liquor (a weak solution of chloride of calcium); and, after this liquor is drawn off, the precipitate is collected and dried.

As the operation of mixing the lime water and the solution of chloride of lead requires to be performed in an instantaneous manner, the patentee prefers to employ for this purpose two tumbling boxes, of about 16 cubic feet capacity, which are charged with the two liquids and simultaneously upset into a cistern, in which the oxichloride of lead is instantaneously formed, and from which the mixture flows into other cisterns where the oxichloride subsides.

The patentee states that although he has only mentioned pure crystallized chloride of lead in the description of the process, yet it is not absolutely necessary that it should be in this form; for a rough chloride, made from lead ore and its equivalent of muriatic acid, boiled to dryness, will answer, provided it be well washed, to free it from chlorides of iron, manganese, or other bodies likely to injure the color of the oxichloride. The exact proportion of pure chloride contained in the rough chloride should be ascertained previous to use, in order that the proper quantity may be mixed with the lime-water. If, however, a solution of chloride of lead of uncertain strength is obtained, or lime-water not quite saturated, they can be used with but little disadvantage; for it is only necessary to be careful not to add an excess of lime (*i. e.* not more than the half equivalent), which can be easily ascertained after a few trials, by filling the lime or lead tumbling-box more or less with its respective solution, as the trials may direct.

The patentee says that it will not be necessary to describe any particular mode of proceeding with soda, potash, ammonia, or barytes; for if ever it should happen that these bodies could be used in preference to lime, it would be merely necessary to make a solution of each of known strength, and to use it with chloride of lead in the same manner as the lime-water.

The patentee claims the manufacture of oxichloride of lead, having the composition of one atom of chloride of lead and one atom of oxide of lead, with or without an atom of water (or an oxichloride of lead as near this composition as the nature of the manufacturing operations may admit), by the use of chloride of lead and lime, soda, potash, ammonia, or barytes. And he claims the application and use of this oxichloride of lead as a white paint, as a base for colored pigments, as an adhesive cement for joints, and for many other purposes to which white lead is commonly applied.—[*Inrolled August*, 1849.]

To ACHILLE CHAUDOIS, *of Faubourg du Temple, Paris, in the Republic of France, manufacturing chemist, for improvements in extracting and preparing the coloring matter from orchil.*—[Sealed 14th February, 1849.]

IN the ordinary mode of obtaining coloring matter from dye lichens or orchil, as much water is combined with the lichens or orchil as will bring the same to a pasty state, and then alkalies, such as liquid ammonia, are added (in some cases potash or urine and lime are used for the same purpose); but the coloring matter obtained in this way is not so pure as that obtained by the process which forms the subject of this invention; because the coloring extract is mixed with the "substantive" parts of the lichens or orchil. Now, the patentee subjects the lichens or orchil to repeated washings in water, until he has extracted the whole of the coloring matter therefrom; and then he treats the water in the same manner as the paste, above mentioned, has been hitherto treated. The lichens or orchil may be washed in hot water only, or in water containing alkaline matters.

The patentee states that he does not claim the obtaining lower one shaft by the revolving motion of the tappet. Each of the eight tappet-plates used for weaving the improved cotton tabby velvets (shewn by diagram in the drawings), will have to be divided into ten parts, or consist of ten divisions, each part having a "riser" or "sinker" cast on, by means of which the shafts are either raised or lowered, as may be required; so that, after a succession of ten sheds, the gait-over of the weft-threads, which are thrown into the sheds of the warp-threads by the shuttle, will be complete; and all succeeding sheds will be mere repetitions of the first ten, being produced exactly in the same manner.

The cotton tabby velvet, now under description, is shewn at figs. 3, and 4; and the manner in which the sheds will have to follow each other will be understood on inspecting fig. 11. 1st.—The first shed is opened out by raising the first, third, fifth, and seventh shafts, and lowering the second, fourth, sixth, and eighth; into which shed a weft-thread is thrown by the shuttle, which thus interweaves the whole of the warp-threads with each other: this first weft-thread is a binder or back-pick, and merely serves to form the back of the cloth, and does not at all enter into the production of the face intended for the plush or pile. 2nd.—The second shed is opened out by raising only the first shaft and lowering all the rest, namely, the second, third, fourth, fifth, sixth, seventh, and eighth; into which shed a weft-thread (represented by the shaded line *a*, fig. 3,) is thrown by the shuttle, which thus interweaves with every eighth warp-thread, namely, the first, ninth, seventeenth, and so on, across the whole width of the piece,—while this same weft-thread floats over the second, third, fourth, fifth, sixth, seventh, and eighth warp-threads of every gait-over: this second weft-thread is a weft-float or face-pick, being altogether used for the formation of the face of the cloth intended to be cut open, in order to produce the plush or pile. 3rd.—The third shed is opened out by raising only the fifth shaft and lowering all the rest, namely, the first, second, third, fourth, sixth, seventh, and eighth; into which shed a weft-thread *c*, is thrown by the shuttle, which thus interweaves only with every eighth warp-thread, namely, with the fifth, thirteenth, twenty-first, and so on, across the whole width of the piece,—while this same weft-thread floats over the first, second, third, fourth, sixth, seventh, and eighth warp-threads of every gait-over: this face-pick is likewise altogether used for the formation of the face of the cloth intended to be cut open, in order to produce the plush or pile. 4th.—The fourth shed is opened out by raising only the third

To **Edward Westhead**, *of Manchester, manufacturer, for certain improvements in the manufacture of waddings.*—[Sealed 3rd March, 1849.]

Waddings are formed of cotton wool or similar fibrous material by taking the cotton wool, as it comes from the carding-engine, and placing layer upon layer until the desired thickness is obtained, and then applying to one surface thereof a coat of size, which hardens and forms the back or foundation of the wadding. The waddings are usually made by hand, and are therefore of limited size or extent; but in the specification of a patent granted to P. A. Le Comte de Fontainemoreau, February 27, 1846, it is proposed to make waddings of unlimited length by machinery: the waddings made by this machinery are, however, coated on the back with size, similar to the hand-made wadding. It has been found that the backs or foundations formed simply by the application of size are of a very perishable character; and this invention consists in forming durable backs or foundations to the wadding by the application of a series of threads or a woven cloth or textile fabric either on to the back or into the body of the wadding. In the case of hand-made wadding, the threads or fabric may be applied in any suitable way just previous to the sizing; and if the wadding is made by the patent machinery above alluded to, the threads or fabric may be wound upon a roller placed at a convenient part of the machinery, in order that the same may be applied to the wadding before the size. The patentee also proposes to substitute a solution of gutta-percha in place of size for the back of waddings.

The patentee, in conclusion, says that he does not claim the manufacture of wadding either by hand or machinery; but he claims the improvement in such manufacture by the introduction of a series of threads or of a woven cloth or textile fabric either on to the back or into the body of the wadding; and he also claims the introduction of a solution of gutta-percha in the place of size for the backs of waddings.—[*Inrolled August*, 1849.]

Scientific Notices.

PROGRESS OF THE AMERICAN PATENT OFFICE.

The following extract from the Report of the American Commissioner of Patents, as it shews the progress of invention in the United States under the cheap system of granting patents, is not without its value to us at the present time, while we re in expectation of some alteration in our own patent law,—

inasmuch as it proves that 30-dollar patents are capable of producing a revenue to that country, after deducting the large expenses which are consequent upon the keeping up of a board of examiners qualified to judge upon the novelty of all inventions presented to them, and on that ground to accept or reject the continually increasing applications made for patents. It would seem that although the American system does not admit of the services of any counterparts to those liberal gentry in our Signet and Privy Seal offices, who collect and pocket the fees "without (as the fee report has it) any expense to the public"—yet it is provided with another kind of dead weight, as useless, if not quite as expensive to the inventive community, viz., the museum of models. It certainly appears, at the first glance, to be a very desirable thing to have a substantive record of the whole mechanical ingenuity of the country collected under one roof, and open to the inspection of all comers,—but if the information we have received from American citizens of the quality of the models deposited, combined with our experience of what has left this country for that national exhibition, will enable us to judge of the general contents of the model rooms at Washington, we may fairly term them a heap of useless lumber. There are of course models to be found in that collection sufficiently perfect in construction to shew the nature of the inventions to which they refer; as, for instance, when washing machines, churns, ploughs, and other such like simple implements, are exhibited; but when the nature of the machinery is complex, and a model is the more requisite (if indeed it is ever necessary), it is very rare to find the invention intelligibly set forth; for the cost of the model would, in such a case, if properly made, exceed the whole expenses of the patent some twenty or thirty times over. The origin of depositing models appears to have arisen from a notion that formerly prevailed of a supposed impossibility of explaining mechanical improvements by means of drawings and a written description. This difficulty was, no doubt, felt in the United States until a comparatively recent period; but now that competent professional assistance may be so readily obtained by inventors, to prepare their specifications and drawings, we do not see that the necessity for continuing the practice of depositing models exists; and the policy, we think, may be fairly questioned, as, by the Patent Commissioner's Report, we find it is a source of continued expense to the country. That models are much less explicit than good drawings, there cannot be a doubt in the mind of any party competent to judge of the matter; for, while outside elevations and plans shew the general contour of a machine, which is all that a model (unless it be a working model) will explain, sectional views will shew the relative connection of all the parts: again, drawings, if intelligible when made, will continue so as long as they exist; but a model may exist, and be perfectly incomprehensible after it has undergone the rough usage of a few rude hands, during an attempt to understand its construction. If, however, the American government is pleased to keep, for the amusement of its citizens, a museum of dwarfed mechanism, it is no business of ours further than as regards the check that it puts to the progress of invention, and the bad example it sets,—which some of our patent law reform advocates are desirous should be imitated in this country. We have already had the satisfaction of stating that the principle of the unequal tax which is levied upon foreigners, and especially British subjects, for an American patent, has met with the condemnation of the Commissioner of Patents; but we fear that the reduction of the tax to 30 dollars would scarcely form a sufficient inducement to the introduction of European inventions so long as the regulation regarding the deposit of models remains in force. The following is the extract to which we refer:—

"The business operations and finances of the Patent Office have expanded rapidly within the last four years. This fact will become more strikingly visible by a contrast of the progress of the office for the last four years with its progress for the four years next preceding. The following statement will exhibit this contrast, viz.:—

Year.	Number of Applications.	Number of Caveats.	Number of Patents issued.	Amount received for Duties and Fees.	Balance carried to Patent Fund, after deducting expenditures, exclusive of money paid for restoring Models, &c.
				DOLLARS.	DOLLARS.
1841	847	312	495	40,413·01	8,253·84
1842	761	291	545	36,505·63	5,292·20
1843	819	315	531	35,315·81	4,588·85
1844	1045	380	502	42,509·26	6,164·79
Total,	3472	1298	2073	154,743·71	24,299·68
1845	1246	380	511	51,076·12	11,680·49
1846	1272	448	619	50,264·16	4,105·45
1847	1531	533	572	63,111·19	21,232·84
1848	1628	607	660	67,576·69	8,670·85
Total,	5677	1968	2362	232,028·16	45,689·63
	3472	1298	2073	154,743·71	24,299·68
Excess,	2205	670	289	77,284·45	21,389·95

"It will be thus seen that the number of applications for patents received during the last four years exceeds the number received during the next preceding four years by 2205; the number of caveats by 670; the number of patents granted by 289; the amount of receipts from all sources by 77,284·45 dollars; the balances paid into the treasury to the credit of the Patent Fund by 21,389·95 dollars.

"It should be remarked, in reference to these results, that, during the first period of four years, more than half the applications for patents were granted; whereas, during the last four years, as has been before remarked, not much, if any, more than three-fifths of them have been granted.

"It is also necessary to observe, that during the first four years there was expended for the restoration of models, &c., the sum of 41,977·31 dollars. If this disbursement had been charged to the account of the expenditures of the office, there would, instead of being an excess of receipts over expenditures of 24,299·68 dollars, have been a deficiency of 17,677·63 dollars. The Patent Fund, therefore, instead of being actually increased, was diminished in the amount last mentioned, during the first period of four years.

"During the second period of four years, the sum of 5257·64 dollars was paid out for the restoration of models, &c. This sum has been reckoned in the account of expenditures for that period, and only the actual balance stated, which was carried to the credit of the Patent Fund; consequently, the Patent Fund has been increased during that period in the sum of 45,689·63 dollars. On the first of January, 1845, the Patent Fund amounted to the sum of 170,779·20 dollars. On the first of January, 1849, it amounted to the sum of 216,468·83 dollars.

"This contrast of the business operations and finances of the office during the two periods above stated, is not made with a view to institute an invidious comparison between the administration of my immediate predecessor and myself—on the contrary, the affairs of the office were administered with great ability, prudence, and economy, by the late Commissioner; but it is made with a view to shew the progress of the institution during the last four years; which is also interesting as an indication of the progress of the country in population and wealth, and in the cultivation and improvement of science and the useful arts."

ON THE PREPARATION OF VITRIFIABLE COLORS FOR PAINTING ON PORCELAIN.

By M. A. Wachter.—*(Concluded from Page 64.*)*

BLACK AND GREY COLORS.

Metallic iridium, as obtained in commerce from Russia, in the form of a fine greyish powder, is mixed with an equal quantity of decrepitated marine salt, and heated to a low red heat in a porcelain tube, through which a current of chlorine is passed. A portion of this metal is transformed into deutochloride of iridium and of sodium, which are separated, by pouring water upon the calcined mass, from the portion of iridium which has not undergone any change. The aqueous solution of the double salt, evaporated to dryness with carbonate of soda, and afterwards treated with water, leaves a black sesquioxide of iridium, which, when dried and mixed with double its weight of flux (prepared by melting together 12 parts of minium, 3 of white sand, and 1 of calcined borax), is finely ground upon glass. The portion of iridium which has escaped the action of the salt and chlorine is then collected and submitted to the same treatment.

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* In the former part of this paper *acide borique* was inadvertently translated as boric instead of boracic acid.

Iridium grey.—Mix well 1 part of sesquioxide of iridium, 4 of oxide of zinc, 22 of flux (prepared by melting together 5 parts of minium, 2 of sand and 1 of calcined borax), and grind them together upon glass. A microscopic examination of iridium colors, when on the porcelain, shews that the sesquioxide of that metal floats, without having undergone any change, in the melted and transparent plumbic glass. It is also owing to the unalterability of the sesquioxide that it possesses the property of mixing with any other vitrifiable colors without spoiling them, as is the case with other vitrifiable grey and black colors.

Cobalt and manganese black.—2 parts of dehydrated sulphate of cobalt, 2 of anhydrous vitriol of manganese, and 5 of saltpetre, are to be well mixed and heated to redness, in a Hessian crucible, until the saltpetre is entirely decomposed. The calcined mass, on being boiled in water, leaves a fine black powder, which is composed of oxides of cobalt and manganese. 1 part of this compound is mixed with 2·5 parts of glass of lead (prepared by fusing together 5 parts of minium, 2 of sand, and 1 of calcined borax), and ground fine upon glass.

Cobalt and manganese grey.—2 parts of the oxides of cobalt and manganese, 1 of oxide of zinc, 9 of flux (prepared by melting together 5 parts of minium, 2 of sand, and 1 of calcined borax), are mixed together and ground fine.

These black and grey colors are much more easily prepared than those from iridium, and are not inferior to them in respect to shade; only they are considered as less suitable for mixing with other colors: their color will be found to change after several times firing, which renders their employment less advantageous. A microscopic examination of these colors shews, moreover, that the oxides of cobalt and manganese are not dissolved by the flux, but are in a state of suspension, without having undergone any change.

In painting, a very fusible black is required, which shall not be attacked by the colors which run or fall upon it on firing. This is obtained by the following formula:—

Black for ground.—5 parts of violet blue (made from gold purple), 1·66 of oxides of cobalt and manganese, and 1·66 of oxide of zinc, are mixed intimately, and finely ground in a glass mortar.

White to be laid over it.—1 part of minium, 1 of white sand, and 1 of crystallized boracic acid, are to be well mixed, and melted in a porcelain crucible. This white enamel possesses the property, when quickly cooled, of forming a diaphanous colorless glass; whilst, if cooled slowly, it is perfectly white and opaque; it possesses this property in common with enamels, the opacity of which is produced by arsenic acid, or tungstic acid. This opacity is probably owing to the precipitation of silicate of lead; as in well-known white enamels the same effect is produced by arseniate or tungstate of potash, or oxide of tin. This enamel is of extreme fineness, for, on being examined with the microscope, it presents the appearance of a yellowish cloud; and, with the highest magnifying power, it has been found impossible to distinguish the molecules.

This white color serves to produce the light parts of designs, when they cannot be obtained by leaving those parts of the porcelain bare; and it is also employed, mixed in small proportions, with yellow and green colors, in order to give them a body.

Flux.—A colorless flux for laying on the painted parts which are left dead, and also for mixing with the easily fusible colors, may be obtained by melting together 5 parts of minium, 2 of white sand, and 1 of calcined borax.

RED AND BROWN COLORS, MADE FROM OXIDE OF IRON.

Yellowish red.—Calcine dehydrated sulphate of iron, in a capsule, placed in an open muffle, stirring continually with an iron spatula, until the greater part of the sulphuric acid is disengaged, and until, on diluting a small portion with water on a glass plate, it presents a fine yellowish-red color. On cooling, the oxide of iron is freed, by washing, from the undecomposed sulphate, and dried. To prepare the color, mix intimately 7 parts of yellowish-red oxide with 24 of flux (prepared by fusing together 12 parts of minium, 3 of sand, and 1 of calcined borax), and grind fine upon glass.

Brown red.—If the calcination of the sulphate of iron be prolonged until the whole of the sulphuric acid is expelled, and a portion on being tried presents a deep red color, an oxide of iron is obtained, very suitable for making brown-red color, which is prepared in the same manner as the yellow red.

Bluish red (Pompadour).—On calcining the sulphate of iron still more energetically, it becomes heavier, and assumes a bluish red tint. The preparation of this color is a very delicate operation, as it requires great nicety to watch for the precise degree of temperature at which the oxide of iron acquires the desired tint; the changes at this temperature being very rapid. The vitrifiable color is prepared by mixing 2 parts of the purple oxide of iron with 2 parts of glass of lead (produced by melting 5 parts of ore, 2 of sand, and 1 of calcined borax), and grinding well upon glass.

Chestnut brown.—This color, throughout its various shades, which range nearly up to black, requires that the oxide of iron shall be submitted to a still higher degree of heat than for reds. The vitrifiable color is prepared by mixing 2 parts of chestnut-brown oxide with 5 of flux (consisting of 12 minium, 3 sand, and 1 calcined borax), and grinding as usual.

Chamois.—1 part of hydrated oxide of iron (prepared by the precipitation of a solution of oxide of iron by ammonia) and 4 of glass of lead (12 minium, 3 sand, and 1 calcined borax) are mixed, and ground finely upon glass.

This color is only applied in very thin layers, and is used merely to produce a yellowish-brown ground.

Flesh color.—1 part of red oxide of iron, 4 of the deep yellow No. 2, 10 of flux (12 parts minium, 3 sand, and 1 calcined borax) are mixed, and finely ground upon glass. This color, like the last, can only be laid on in thin layers, and mixed with iron-red, azure, or brown-yellow, No. 2. Any required shade may be given to this color. The red for cheeks and lips is produced by laying over this color the pompadour red.

When viewed under the miscroscope, after firing, these colors shew clearly that the oxide of iron is suspended in the limpid flux, without having undergone any change: at any rate the portion dissolved in the flux is so small that it is not perceptibly affected by it.

BROWN COLORS.

Light brown, No. 1.—6 parts of dehydrated sulphate of iron, 4 of sulphate of zinc, also dehydrated, and 13 of saltpetre, are carefully mixed, and introduced into a Hessian crucible, which is heated until the nitrate of potash is entirely decomposed. After cooling, the crucible is broken, and the residuum is collected and deprived, by washing, of its soluble parts. The result is a yellowish-brown powder, which is a combination of oxide of zinc and iron. The vitrifiable color is prepared by mixing and finely grinding 2 parts of oxide of zinc and iron, and 5 of glass of lead (composed of 12 parts minium, 3 sand, and 1 calcined borax).

Light brown, No. 2.—2 parts of dehydrated sulphate of iron, 2 of anhydrous sulphate of zinc, and 5 of saltpetre, are treated in the manner indicated for light brown No. 1, and the color is prepared in the same manner, from the oxides of zinc and iron resulting therefrom,—whereby a somewhat lighter shade is obtained.

Light brown, No. 3.—1 part of calcined sulphate of iron, 2 of anhydrous sulphate of zinc, and 4 of saltpetre, are treated in the same manner as for light browns, Nos. 1 and 2. These light browns, on being inspected under the microscope, when on the porcelain, and after firing, shew the diaphanous particles of the yellowish oxides, zinc and iron, suspended in a colorless glass of lead.

Bistre brown, No. 1.—1 part of calcined sulphate of manganese, 8 of anhydrous sulphate of zinc, 12 of anhydrous sulphate of iron, and 26 of saltpetre, are treated as for light brown, No. 1; and the dark brown powder which is the result, and which is composed of oxides of zinc, iron, and manganese, is mixed with an equal weight of the same flux as for light brown No. 1, and finely ground.

Bistre brown, No. 2.—1 part of calcined sulphate of manganese, 4 of calcined sulphate of iron, 4 of calcined sulphate of zinc, and 12 of saltpetre, are treated in the same manner as for bistre No. 1. The color is a little deeper.

Sepia brown, No. 1.—1 part of calcined sulphate of iron, 1 of calcined sulphate of manganese, 2 of calcined sulphate of zinc, and 5 of saltpetre, are treated in the same manner as for light brown No. 1; and the greyish-brown substance resulting therefrom is mixed with 2½ times its weight of the same flux, and ground fine.

Sepia brown, No. 2.—1 part of calcined sulphate of iron, 2 of calcined sulphate of manganese, 6 of calcined sulphate of zinc, and 10 of saltpetre, are treated in the same manner as for the sepia brown No. 1; and the result is prepared in the same way.

Deep brown, No. 1.—1 part of dehydrated sulphate of cobalt, 4 of dehydrated sulphate of zinc, 4 of calcined sulphate of iron, and 10 of saltpetre, are mixed in the same manner as for light brown No. 1. The product, which is of a fine deep reddish-brown, is mixed with 2½ times its weight of the same flux as for the preceding color, and finely ground.

Chrome brown.—1 part of hydrated oxide of iron is mixed with 2 parts of chromate of protoxide of mercury, and the whole ground upon glass to mix it more intimately; it is then heated to redness in a capsule, which is introduced into an open muffle, until all the mercury has been driven off. The product, which is of a deep reddish-brown tint, and is a mixture of the oxides of chromium and of iron, is mixed with three times its weight of flux (prepared by melting together 5 parts minium, 2 sand, and 1 calcined borax) and ground upon glass.

When inspected through a microscope, upon the porcelain, these various brown colors shew that the compounds of brown-colored oxides are merely suspended in glass of lead, and a very small quantity is dissolved in the flux. The dry mode of preparation indicated for these combinations of oxides (which imparts different shades to the brown) is more economical and certain than that of the precipitation of mixed solutions by carbonate of soda and the calcination of the precipitate after washing: this latter mode is however effectual. If, instead of combining them, it were desired to mix some oxide separately with the flux, colors might be obtained which would present a different tint when laid on in different thicknesses; besides which, their color would be totally altered by the firing operation, and therefore they could not be advantageously employed, on account of the uncertainty attending their use.—[*Technologiste.*]

ON BONE-GLUE OR GELATINE.

By M. Schattenmann, *Superintendent of Mines at Bouxwiller.*

The intrinsic value of gelatine or bone-glue, which is superior in quality to all other kinds of glue, may be pretty correctly ascertained by immersing it, during twenty-four hours, in cold water, when it will absorb a quantity of water proportionate to the quantity of glutinous matter which it contains. The sheets of glue are weighed before they are immersed in the water, and, after having been allowed to soak for the required time, they are taken out, wiped dry, and again weighed, when it will be found that the weight will be increased according to the quality,—the quantity of adhesive matter bearing an exact proportion to the increased weight of the sheets. The bone-glue produces nearly double the quantity obtained from ordinary glue. After immersion, as above, it is firm, white, and will resist decomposition during a considerable period; whilst the ordinary glue is soft, lacks consistence, is of a brown color, and quickly decomposes, especially in summer. Common glue cannot be employed for sizing or dressing warps of cotton fabrics, when printed, as it spoils the colors by decomposition. That made from bones, on the contrary, may be advantageously employed for both these purposes. The adhesive properties of bone-glue are, besides, so great that, on endeavouring to disunite two pieces of wood joined together by it, the wood will sooner break than tear asunder at that part.

In order to obtain glue of suitable consistency, it is only necessary to dissolve the jelly, obtained by immersion as above, by the application of heat without water. The most convenient method is by means of a boiler, provided with a steam-jacket.

The observations of M. Schattenmann have led him to believe that the water contained in the jelly or fresh glue is not in the form of a mere mixture, but is a component part thereof, which renders the dessication of the glue more difficult; and that, by dissolving dry glue, the jelly obtained dries much more quickly, as the same primitive combination does not exist between the water and the adhesive matter. Dry glue also contains more or less water of composition, which renders it hygrometric. Inferior glue contains it in much greater quantity; and the humidity of the air which it absorbs softens it and destroys its adhesive quality. The employment of green glue, or of the first jelly obtained by melting the glue, can only produce injurious effects; l it is important, in order to obtain glue upon which damp shall have no influence, to dry it, and even to re-dissolve and dry it a second time, in order to deprive it entirely of its water of composition, and of all hygrometric properties. The advantage of this treatment is proved by experience, although no reasons have yet been given for it. Workmen in wood, and more especially musical instrument makers, and others for whom good glue is desirable, sometimes dissolve it and again dry it, in order to render its dessication more complete. Glue in thin sheets is necessarily more easily dried, and contains less water than in thick sheets; it will therefore be understood that the former are much more advantageous.

Formerly, when paper was sized with common glue, many establishments employed it in the green state; in which case, the paper often emitted a bad odour, in consequence of the decomposition of the size. It has, however, been recommended in several manufacturing towns as a novel and very economical application; and it would appear that it had been employed in several manufactories and establishments for sizing. Very little economy can however be effected; and serious disadvantages may result from the substitution of green for dry glue, from the fact that green glue dries with greater difficulty than dry glue dissolved; and that the former is extremely hygrometric, and readily absorbs humidity from the air. It is, consequently, liable to decomposition in hot and damp weather; and, when employed for sizing fabrics, will spoil their colors and infect them. It is, in fact, very dangerous to employ it for this purpose, as the goods may appear to be properly dressed and dried, and yet be liable afterwards to absorb sufficient humidity from the air to cause decomposition and emit an offensive odour. This disadvantage has already been experienced; and is more especially to be feared in summer, and in hot and damp climates.

M. Schattenmann concludes by observing that he considers these remarks upon the properties and employment of glue and size to be worthy of attention, as shewing the undoubted superiority of dry bone-glue or gelatine.—[*Ibid.*]

NEW KIND OF GUTTA-PERCHA.

It is stated in a recent number of the *Amsterdam's Handelsblad*, that there is every reason to believe that at Palembang, in the Eastern possessions of the Dutch, in the interior of the country, gutta-percha, or *getah pertja*, will be collected in great abundance. It would appear also that another substance has been discovered, called *getah-matah-buay*, which is also obtained in great abundance, by merely bleeding the trees; and which, although not susceptible of the same extended applications as gutta-percha, may, nevertheless, when mixed with this latter, prove of very great utility.

Scientific Adjudication.

SOUTH LANCASHIRE ASSIZES.

NISI PRIUS COURT.—*Before Mr. Justice Wightman.*

SELLERS *v.* DICKENSON.

THE plaintiff in this case was a cotton spinner, at Burnley, and the defendant was a machine-maker at Blackburn. The action was brought to recover damages for an alleged infringement by the defendant of a patent for certain improvements in power-looms, taken out by the plaintiff, and duly enrolled in 1845. The defendant put upon the record the usual pleas in cases of this description, denying that he had infringed the plaintiff's patent, or that the plaintiff was the first inventor; and alleging that the specification of the plaintiff's patent was bad; that it had not been duly enrolled; and that the invention was of no use. Mr. Martin, Mr. Atherton, and Mr. Webster, were for the plaintiff; and Mr. Watson, Mr. Crompton, and Mr. Cowling, for the defendant.

Mr. Martin in opening the plaintiff's case, said that in weaving, the shuttle was liable ocasionally not to go completely across, between the warp threads from one shuttle-box to the other, but to stop in its course between those points. Now, if while the shuttle was in this position, the slay (the beam which moves backwards and forwards, and presses the weft-threads upon the warp) were to continue its motion, the effect would obviously be that it would strike against the shuttle when between the warp threads, and would at all events break these, if it did not injure the loom itself. In the hand-loom the weaver had to watch the shuttle, and if it stuck in the "shed" (the technical name for the space between the warp threads), he stopped the motion of the slay immediately, and thus prevented its striking against the shuttle. Of course this could not be done in the power-loom, and a mechanical contrivance was therefore necessary, in order to stop the slay as soon as the shuttle stuck in its course. The invention which the plaintiff had patented was such a contrivance. The learned counsel then proceeded, with the aid of models, and working sections, to describe the method by which this object was accomplished in the original power-loom; in that invented by a person named Bullough, for which a patent was taken out in 1842; and in the plaintiff's machine, the patent for which was taken out in March, 1845, and was enrolled in the September of that year. These descriptions will be found in detail in the evidence of the scientific witnesses called in support of the plaintiff's case.

Mr. B. Fothergill, of the firm of Roberts, Fothergill, and Dobinson, Globe Works, Manchester, said:—For the last 30 years I have been practically acquainted with the various kinds of machinery used in Lancashire and elsewhere. I was for some time the foreman to the house of Sharp, Roberts, and Co. Mr. Roberts introduced various improvements into the power-loom, many of which were patented. I am well acquainted with the power-loom and the various improvements that have been made in it from time to time. The bringing of the power-loom into practical operation is within the last twenty years. Before that time, the weaving was by hand. In the hand-loom, the slay was moved by the weaver's left hand, the shuttle being thrown by the right; in the power-loom, both are moved by power. There is a shuttle-box at each end of the slay, to receive the shuttle. It happens both in hand and power-loom weaving that the shuttle sometimes fails to travel completely from the one box to the other; it then becomes important to stop the action of the power-loom by some mechanical invention. I am acquainted with the original power-loom. In that machine, a frog was fixed upon the side framing of the loom. When the shuttle was absent from the box, and was trapped in its course: the stop-rod finger, not being elevated, came in contact with the frog, and arrested the progress of the slay at such a point as to prevent the shuttle breaking the warp threads;—at the same time throwing the spring-lever handle out of its place, and passing the strap from the fast to the loose pulley. The effect of that was to stop the motion of the slay and of the whole machine instantly. The concussion arising from the stop-rod finger coming in contact with the fixed frog, being so violent, frequently broke various parts of the machinery. The shock here is received upon the frog, which is firmly fixed upon the frame of the machine. When the shuttle was trapped, the stop-rod finger was not raised, because the shuttle was absent from the shuttle-box, and did not press the "swell," which raised the stop-rod finger. I know Bullough's machine. Instead of accomplishing the stopping of the loom by means of the shuttle acting on the swell, as in the former case, the shuttle, when in the shed (or pathway between the threads) and when trapped, came in contact with the reed in the slay; and, that reed being suspended on the pivot at the upper part, was driven back against a finger which operated upon the spring handle, and by that means threw the strap from the fast to the loose pulley, and stopped the machine. Before Bullough's invention the reeds were fixed; and, for general purposes, a fixed reed is preferable, because with them you can weave either light or heavy goods. In Bullough's machine there is also a brake. At the time that the spring handle is liberated, so as to pass the strap from the fast to the loose pulley, there was a catch liberated, and so soon as that liberation took place, the lever forming the brake was pulled down at the end nearest the spring handle, by means of a spiral spring; the other end, forming the brake, being brought to bear upon the fly wheel, and gradually (not instantaneously) arresting the progress of the machinery. In the plaintiff's invention, the whole of the momentum imparted to the slay, and consequently to the stop-rod finger, is received on a notch at the upper end of a vertical lever (which is the representative of the frog), and by that means is transmitted to the brake. The brake, being suspended on a pivot, is brought in contact with the periphery of the fly-wheel, and immediately stops the machinery. The slay cannot then beat up any further. This arrangement has this property,—that the greater the velocity, the greater is the action of the brake upon the wheel; and the result is, that machinery arranged in this way can be run at a higher velocity, because the concussion alluded to in the first model is entirely removed in this case, and therefore the machinery is not liable to breakage. This was entirely a novel arrangement, as far as I know, and if any similar arrangement had existed within the last thirty years, I should in all probability have known of it, particularly if it had been patented. Before the plaintiff's machine, I never heard of the motive power of the machine being employed to stop it: in this case, the power by which the machine is put in motion and is stopped is identical. The stoppage here is immediate. The arrangement of the clutch-box in the plaintiff's machine is also a great improvement. The object of the arrangement of the clutch-box is to disengage the strap and throw the machinery out of gear. It has been found in practice that the power of the brake in the plaintiff's machine has been sufficient to stop the machine, without the clutch-box being brought into play. A mechanic of ordinary skill, accustomed to construct machines, could make the plaintiff's from his specification. I have seen some power-looms at the mill of Messrs. Radcliffe and Stone, at Blackburn. They are weavers by power. I saw them on the 17th instant. They were the defendant's machines. The only difference between those machines and the plaintiff's is, that in the defendant's the stop-rod finger acts on a sliding piece or loose frog, from which projects a pin. That pin is brought in contact with an inclined plane at that end of the lever, forming the brake, which is furthest from the wheel. In this case, as in the plaintiff's, the machinery is stopped by a brake acting upon the wheel; and the motive power is the same in both. There is no difference between the machines, except that in the plaintiff's machine there are two vertical levers with a connecting link, to apply the brake; and in the defendant's there is one horizontal lever. The action, the effect, and the mechanical power, are the same in both. I have also seen some power-looms at the mill of Mr. Samuel Hibbert, Blackburn, on the 17th inst. In that machine the lever and brake were placed in a different position relatively to the fly-wheel. In this case the stoppage was effected by a brake, and the operation was precisely the same as in the former cases. In the former cases the lever was acted upon by the end being pulled down; in the latter case the power is obtained by a direct pull upon the brake. Both are modified applications of the same power. I also went to the mill of Mr. Forest, at Blackburn. The application of the brake was in the same way as in Hibbert's machines.—Cross-examined. I have known power-looms 25 years. Power-looms had not, from the first, the stop-rod. I should say that that rod has been employed for more than 20 years. All the rods had a finger to stop the loom. Before the plaintiff's patent the finger struck upon a sliding piece or moveable frog, which detached the spring-handle, and this threw the strap from the fast to the loose pulley. Then the finger struck upon a frog, fixed upon the framing of the machine. I had, before 1845, the date of the plaintiff's invention, seen power-looms where the whole frog, and not a piece merely, was moveable. The effect of this was to act upon the spring-rod and throw it out of gear. In that case, however, the motion was not stopped immediately; but was continued, and the finger and moveable frog struck the fixed frog. Before 1845, a brake was commonly applied to the fly-wheel,—the levers putting on the brake were put in motion by the action of the finger of the stop-rod. The brake was not new. The lever of which the brake is formed is not new. In Bullough's machine the lever-brake was not caused to be put in motion by the finger. In the plaintiff's machine there is the upright lever, but not what is ordinarily called a frog; there is a notch at the upper part of the vertical lever, which answers the purposes of the frog. I have not seen any looms with the clutch-box and lever combined, though I am told there are some. I never saw a loom with the two vertical levers and the connecting-rod. I do not know that the plaintiff ever made any; nor that they broke down as soon as they were started. I do not see why they should. In the old looms there were two pulleys, a fast and a loose pulley; and when the machine is thrown out of gear, the strap is transferred from the fast to the loose pulley. In the plaintiff's machine both pulleys are loose, but one is made fast by the clutch-box, and the throwing out of gear is done by making that pulley loose, which was before fastened by the clutch-box. The clutch-box had been used before in power-looms for stopping and setting on. In the plaintiff's it is used for stopping only. The object of the invention is to prevent concussion; and in order that the brake should act as well as possible, a clutch-box is applied to disconnect the motive power, leaving the momentum to be dealt with by the brake. I cannot say whether the tail of the lever in the machine I saw at Radcliffe's was an elastic lever. The end of the lever furthest from the wheel is not at all fixed to the frame; the pin slides up the incline, and forces the brake against the wheel. By the plaintiff's machine, the inclined plane is so steep that the stoppage is instantaneous. If the lever were a spring, the stoppage would be more gradual, in proportion to the elasticity of the lever. There is no difference between the moveable frog in the defendant's machine and that in use before. The great objection to Bullough's patent is, that the action of the brake upon the fly-wheel is gradual, whereas that of the plaintiff's is instantaneous. That advantage is gained by the rigidity of the levers.—Re-examined: The old moveable frog was upon a portion of the frame. When it was brought to a stop, it acted upon the body of the entire frame; and assuming the plaintiff's notch to be substituted for the frog, the advantage is, that the shock operates upon the lever and not upon the frame. And in the defendant's machine, he also gets rid of the shock upon the frame. There is no difference between the method in which he gets rid of the shock, and that in which the plaintiff attains the same end. I never saw the clutch-box used in combination with the brake to stop the looms in case of the trapping of the shuttle, before the plaintiff's invention.—By the jury: The plaintiff's machine would cost the most in construction. There would not be much difference between the cost.—Mr. Bennet Woodcroft was then examined at considerable length, and gave evidence as to the nature of, and difference between, the various machines. He coincided with Mr. Fothergill in the opinion that there was a fundamental difference in the mode of stoppage between the plaintiff's and all former machines; but that the principle of the defendant's machine was exactly the same as the plaintiff's, though applied in a somewhat different manner.—Mr. Samuel Hibbert, a weaver at Blackburn, had been engaged in that business for 35 years. Sellers' brakes had been put on his looms by the defendant, and these looms were those shewn to Messrs. Fothergill and Woodcroft. The defendant made 240 on this principle. The defendant's bill was then put in, by which it appeared that he styled the brake "Sellers' brake," and that there had been paid to the plaintiff "a royalty" of 2*s.* 6*d.* each for them. The plaintiff's invention was an exceedingly useful one, and enabled as much work to be done in 58 hours as previously occupied 69.—Cross-examined: The looms were ordered from Dickenson in 1846.—A witness was then called, who produced a letter from the defendant, guaranteeing him against any action that Sellers might bring against him on account of the use of his Dickenson's loom.—Mr. Radcliffe, a power-loom manufacturer at Blackburn, said that three or four months ago he had had about 130 looms made for him by Mr. Dickenson. They were the looms of which Messrs. Fothergill and Woodcroft had spoken. —Cross-examined: The order for these looms was given in April last. Mr. Hill was foreman of Messrs. Sharp Brothers, of Manchester: he had heard the evidence of Mr. Fothergill and of Mr. Woodcroft, and concurred entirely in their opinion. The means employed by the plaintiff were new to witness when he first heard of the plaintiff's patent.—Mr. William Kenworthy, of Blackburn, had been connected with the weaving of calico for 35 years, and he and his partners had 1400 looms on their premises. Had heard the evidence of Messrs. Fothergill and Woodcroft, and agreed with it entirely. Had never heard of a brake being applied to stop concussion, before the plaintiff's invention. With that invention the machinery could be run a fifth or sixth quicker than before.—Mr. John Baines, of the firm of Pilkington and Brothers, Blackburn, had applied the plaintiff's brake to about 500 out of the 1400 looms which that firm had. He concurred with the previous witnesses in their opinion of the principle of the different machines, and of the great usefulness of the plaintiff's invention.—Mr. Robert Miller had been many years manager of the loom department of Messrs. Forrest, at Blackburn, and had been for 15 years conversant with looms. He agreed with the evidence of Messrs. Fothergill and Woodcroft. He also gave evidence of the novelty and usefulness of the plaintiff's invention.—James Abbot was then called; and, in cross-examination, he stated that he had made the machine used by Mr. Hibbert, after seeing the plaintiff's original machine with the vertical levers.

Mr. Watson, and the counsel who were with him, then took several objections to the validity of the specification, the nature of which will be seen by his lordship's decision after argument.—His lordship said that it had been objected that the clutch and its application, and the frog and its application, which had been claimed by the plaintiff, were not new; and that the principle on which brakes were used in connection with power-looms, if that was new, was not what was claimed by the specification, which was said to be only for the arrangement. Now, he found that in two places in the specification, the plaintiff claimed for a "novel arrangement of mechanism." The novel arrangement of mechanism was said to be an arrangement to effect that which had not been effected before,—namely, the instantaneous stopping of the machine when the shuttle was stopped in the web, and that this was effected by a combination of the clutch, and the application of the power of the machine to stop it, by bringing it to bear upon the brake. Now the defendant's machine had not infringed the plaintiff's patent with respect to the clutch-box, for it had it not. Then came the question—Had the defendant's infringed the "novel arrangement of mechanism?" and that raised the question of fact for the jury,—whether the arrangement that the defendant had made, so far as it related to the brake,—was that of the plaintiff or was different. Now the witnesses had no doubt said that the arrangements of the two looms were different; but the question would be, whether that meant that the arrangements were different merely in their precise position and situation, or whether the arrangement was substantially different. On the part of the plaintiff, it was said that the arrangement was substantially the same, and that the difference was only in what met the eye. The question for the jury would be,—whether "the principle of the arrangement" had been infringed? As his Lordship declined to nonsuit the plaintiffs, without allowing them leave to move, the defendant's counsel decided to go into their case.

Mr. Watson then addressed the jury for the defence. What the plaintiff claimed was, the arrangement of the machinery; and yet, though he said that it was both new and useful, he had never made a machine after his original specification. He has claimed to be entitled to the brake upon the fly-wheel, and not the combination in question. Now it could be proved that the brake had been used long before the patent of the plaintiff. He should shew that the clutch was neither new nor in any way useful. The plaintiff had patented the arrangement by two vertical levers, and had then claimed that no one should use the lever as applied to the brake at all; let him keep to his vertical levers, and not seek to prevent others from making beneficial alterations upon them. He should shew that the plaintiff's loom could not be used without considerable improvements. In the defendant's brake it was important to observe that the lever was elastic; while the plaintiff's was rigid. He should shew that patents had been obtained some time anterior to the plaintiff's, for the various things which he claimed as novelties.

The following witnesses were called for the defence:—

John Oddy said: I am managing foreman to Messrs. Harrison, machine makers, Blackburn, and have been acquainted with the making of power-looms for about 14 years. I know Dickenson's patent. I know the levers in the defendant's machines. I have tried two or three, and have found them to be made of steel. They thus ease the blow upon the fly-wheel and the frog. I cannot say whether the elastic lever is better or worse; but the loom would stop with a less violent shock than with the rigid lever. The stoppage is not so instantaneous by the elastic as by the rigid lever. I have known the whole frog moveable upon the frame before 1845. While the frog is working up the inclined plane it does not actually touch the frame of the machine, by reason of the resistance of the spring-lever. The old moveable frog touched the frame. The difference between the two machines is, that one has a rigid and the other an elastic lever. It is possible to make, but not to work right, the plaintiff's machine with vertical levers. The joints would get play, and the stop-rod finger would get over the notch and injure the machine.—Cross examined: We have made 700 or 800 looms after Sellers' plan. They were not made with vertical levers, but like those at Hibbert's. I have heard that a sum of money was paid as a license to the plaintiff for the making of these. The defendant's machines have a lever which is nearly rigid; the elasticity would be about three-eighths of an inch.—Re-examined: The frog could not travel at all if the lever was entirely rigid. The straight levers, we used in the machines we made with the plaintiff's brakes, were fastened with a frog.—Daniel Mills: I am in the employment of the defendant, and have made all the levers for him. They have been made of the best spring steel.—Cross examined: We made about 200 looms for Mr. Hibbert with the plaintiff's breaks. I never heard Mr. Hibbert complain of these brakes; but the men complained of the severity of the concussion with them.—Thomas Stephenson, of Lower House, was a power-loom overlooker at Messrs. Dugdales', at Padiham. Had seen Dickenson's looms; they had an elastic lever, and were better than the plaintiff's, inasmuch as they stopped the loom less suddenly.—Thomas Stephenson, Blackburn: I have been acquainted with power-loom weaving for 40 years. Made power-looms myself in 1835. I made about half a dozen looms on the principle of the one produced. Some went to Mr. Abbott's, of Blackburn, where they were woven with; others went to Mr. Cunliffe's, of Darwen. The finger of the stop-rod in my machine acted upon a moveable frog, attached to and sliding upon the frame. The frog has a connecting-rod, which is rigid, and moves by the frog. This rod is attached, at the other end, to a lever, which is connected with an axis, which carries the lever to a notch upon the fly-wheel, which is then stopped. The power of the steam-engine operates through the lever and notch upon the fly-wheel, to stop it. The lever presses against the wheel before it reaches the notch, but does not stop it before it reaches the notch; nor does it operate as a brake to any considerable extent.—Cross examined: I was in partnership, in 1835, with a man named Robinson. I worked as a principal for about six or eight months; and have since worked as a journeyman. We did not make more than six looms of the kind I have described. These four looms were broken by some means, and replaced by the old ones at my expense. It was not exactly because the thing was a failure. Mr. Cunliffe's also broke; and we ceased to make any more.—Re-examined: It was not so long after they began to be used that that broke. They might have been at work for a month or two.—John Oddy was then re-called, and said that he had made a machine like that of the last witness. It had no difference except that the lever had a lining of leather, which lessened the blow, and made it lay on the wheel a little before it came to the notch, and act as a friction-brake. I made this machine in 1842. Hearing that Stephenson had made something like this machine he took off the lever.—John Railton: I was a machine maker at Blackburn. I have made a power-loom with a brake upon the fly-wheel. I made about twenty for the Brookhouse Mills in the year 1835. The brake was applied by a weight, which fell and allowed the brake to press the wheel. Had made another kind of loom about twelve years ago. The brake had a connecting-rod with the frog. The frog was sliding. A projecting-finger from the spring-handle struck the frog. The frog and brake had a connecting-link or rod. As soon as the frog went forward the brake acted on the wheel. There was no notch upon the fly-wheel. It was a friction-brake. The power of the loom was communicated through the frog, so as to put the brake upon the fly-wheel.—Cross examined: There are three or four in court who saw the latter kind of brake. I sent the looms to Mr. Kenworthy's, who was proprietor of the Brookhouse Mills, but not with my brake. I took out a patent for stopping looms in 1842, but not for this invention. I perhaps made six or a dozen of this description of brake.—Re-examined: Kenworthy's brake was moved by a lever with a weight.—James Nuttall: I remember being employed in 1834 about Ramsbottom's patent. I made out the specification of that patent. Power was transmitted from the finger of the stop-rod by a sliding-bar, which came against a notch on the fly-wheel, and stopped the fly-wheel. Before the bar got to the notch it partially stopped the wheel by friction. We had not the brake originally; but we found that the concussion caused by the notch upon the fly-wheel coming against the bar was so tremendous, that we must have something to break the blow. There was then a notch put upon the fly-wheel, which caused the sliding-bar to rise and pull the brake against the wheel; this softened the blow. The brake in this case was given from the sliding-bar, which was raised by the fly-wheel. The power to brake the wheel came from the engine. This machine was worked in 1834. Cross examined: The brake was attached to a slide, which had a nib upon it, which met a nib upon the wheel and stopped it finally.—Re-examined: The brake was put on to soften the blow. I have seen the brake stop the loom without the nibs coming in contact. We never meant to apply it in that way, because we were sure of stopping the wheel by the nibs.— Samuel Halstead, overlooker at Messrs. Firth and Howarth's Mill, Todmorden, proved that he had woven with the loom described by Nuttall. There were two in operation, and some others unfinished, when he left the mill.— William Corless, a mechanic, formerly in the employment of Railton, corroborated Railton's statement as to the construction of his looms.—Cross examined: Five or six looms were made. Did not know where they were sent for.—James Ormerod, formerly in the employment of Railton, had seen brakes applied to looms, but could not describe them.—Henry Tattersall, also a mechanic at Railton's, described the looms made by him.—Henry Booth corroborated the evidence of the previous witnesses.

Mr. William Carpmael.—I am very extensively employed in taking out patents, and drawing specifications. My attention has been drawn to the inventions in connection with the brake upon the power-loom. Miller's patent, in 1796, relates to the clutch-box. Miller had a fast and loose pulley; and the plaintiff has a loose pulley, and a fast and loose pulley. That is the only difference between them. The plaintiff's invention is an absurdity in this respect. I know Holt and Ramsbottom's patent, of 1834: that had a sliding-rod put in motion by the slay; that sliding-rod had a nib, which, coming in coincidence with a nib on the fly-wheel, locked and stopped the loom. These looms, with the alteration upon the brake described by Nuttall, are substantially the same as Hibbert's (the plaintiff's), except in the arrangement. The arrangement and shapes of the instruments are all different. The manner of action of all these looms is this: the finger moves the rod, the rod moves the brake, and the brake, coming in contact with the wheel, stops it; in addition to which, in Ramsbottom's there are the nibs. The sliding rod of Ramsbottom's is the moveable frog of Hibbert's. The operation of the brake is the same in both. I heard Stephenson's account of his invention. The difference between that and the plaintiff's machine at Hibbert's is, that the lever, if it bears against the wheel before it comes to the notch, is a friction brake; but if it comes at once against the notch, gives a dead stop. It is identical whenever it offers a friction surface and acts as a brake. Oddy made Stephenson's a positive brake; before that, it was only partially so. There is no difference between Railton's and the plaintiff's machines at Hibbert's, in the mode and manner of action. In one, there is a lever of the first, and in the other one of the second power; that is the only difference. Otherwise, the two machines are instrument for instrument the same. I have looked closely through the plaintiff's specification. In the plaintiff's model, there is a stop to prevent oscillation, which is not in his specification, but is in the drawing attached. The plaintiff's machine, made according to the specification, with the vertical levers, would not work practically, and the shock would be the same as in the old loom where no brake at all was used. Hibbert's is a different arrangement from that shewn in the plaintiff's drawings attached to the specification. In the machines at Radcliffe's, the lever has an elastic tail, and it has formed upon it an inclined plane; it is not connected with the frog. That is the difference between that and the plaintiff's loom. The effect of the differenee is, that the frog put in motion by the slay rises upon the incline, puts on the brake, deflects the tail of the lever, and thereby absorbs the power; and any rebound that takes place will not take off the brake; the brake will only be taken off by the straightening of the lever, which will take some time. Therefore the manner of the effect and action are different, though they all derive their power from the same source. The wheel and frog are both acted upon by elasticity; the blow, instead of being instantaneous, is prolonged; it becomes a push instead of a blow. The defendant's is a decidedly valuable improvement; it has all the advantages of the other with none of its disadvantages.—Cross-examined: The specifications were laid before me on the 18th, and I reported on the 20th. I have never seen the real looms at work, but only the models. I only speak theoretically in what I have said about the looms. Mr. William Nicholson:—I am acquainted with machinery, and reside in Manchester. I am practically acquainted with machinery. I fully agree with Mr. Carpmael in the evidence he has given.—Cross-examined: I am a patent agent at Manchester.

Mr. Martin then replied upon the whole case. In the year 1845 it was admitted that, notwithstanding the inventions that were said to have been made previously to the plaintiff's, one of the most extensive machine-makers in the world, and one of the most extensive spinners in the world, knew nothing about it; and that the mode of stoppage was that adopted in the original power-loom. With regard to the utility of the plaintiff's invention, he should, with confidence, oppose the evidence of Mr. Fothergill and Mr. Hill (persons practically acquainted with the subject) against that of Mr. Carpmael, who was a mere theorist. Since 1845, the machine of the plaintiff had been in extensive use. He did not deny that a machine such as Railton (speaking from a drawing made for the purpose of this trial) had said that he had invented, was pretty much the same as that of the plaintiff's; but could the jury believe that a machine in that perfect form had been invented by him? For he said that only five or six machines of the kind were made, and it never succeeded; while the plaintiff's machines instantly succeeded. The real truth of the matter was, that a man like Railton, who was accustomed to dabble in patents, now, on a drawing being put into his hands substantially like the plaintiffs, fancied that he had, fifteen or sixteen years ago, invented the same thing. It could not, however, have been the same, or it would have met with the same success. Stephenson's invention was nothing more than a lean-to, catching a notch in the wheel; the shock must be such as would break the wheel to pieces. To call that a brake, such as the plaintiff had taken out a patent for, was a sheer piece of nonsense. With respect to Ramsbottom and Holt's patent, according to the specification the stoppage was effected by a nib on the sliding bar meeting a nib on the wheel; but then Nuttall said that they put a brake on below, as an auxiliary to the nibs; yet still they never dreamt of depending on the nib alone, and that therefore he apprehended did not vitiate the present patent. He thought, therefore, that he had disposed of the three attempts to shew previous inventions. The whole of the defendant's case was a mean attempt to defeat the claim of a man who had invented a most useful improvement, by putting forward the utter failures of three other people. With regard to the infringement of the patent, Kenworthy's foreman had had made from Sellers' machine, by the defendant, a machine for which Mr. Kenworthy paid a royalty to the plaintiff; and the defendant having then got what Mr. Kenworthy and his foreman had made as Sellers'—made what he called "Sellers' brake" for some time; and then, in 1848, he and some patent agent had put their heads together, and persuaded themselves that they could escape the consequences of an infringement of the plaintiff's patent, if the defendant's lever was elastic,—the plaintiff's being rigid. The patent, however, was protected against anything that counterfeited or imitated the same, and he contended that the elasticity was only a colorable difference, and that, even supposing that it was an improvement, it was not so elastic in the defendants's loom as to create any real difference; for neither Mr. Fothergill nor Mr. Woodcroft had been able to discover the elasticity.

His Lordship, in summing up, said that the claim of the plaintiff was not for the principle either of stopping power-looms by means of the clutch-box, or of stopping them by means of a brake upon the wheel; but it was for a novel arrangement of mechanism, designed for the purpose of instantly stopping the whole of the working parts of the loom whenever the shuttle stops in the shed, without such a concussion as would endanger or damage the machinery. The means which he had described as his novel arrangement was "by disconnecting the main driving pulley from the driving shaft by means of a clutch-box and machinery upon it, and also by bringing a brake into connection with the fly-wheel to prevent the slay from beating up any further and injuring the cloth." It is an arrangement of machinery to stop looms by means of the action of a clutch-box in combination with the brake, as described in the specification. It was not suggested that the defendant had infringed the plaintiff's right, supposing that he had one, by any machinery in which there was a combined action of the clutch-box and brake; because the defendant had no clutch-box at all. If, therefore, the whole depended upon the combined application of the two, undoubtedly the defendant had not infringed the plaintiff's machine, because he left out the clutch-box. But it was said that he had done so by bringing a brake into connection with the fly-wheel. He proposed, therefore, to leave the following questions to the jury:—Is the plaintiff's arrangement of machinery for stopping looms by means of the action of the clutch-box in combination with the action of the brake, as described by the plaintiff, new? is it useful? is the plaintiff's arrangement of machinery for bringing the brake into connection with the fly-wheel new? is it useful? is the arrangement of machinery for bringing a brake into connection with the fly-wheel, in the machines made by the defendant for Hibbert and Radcliffe, the same substantially as the plaintiff's arrangement of machinery for that purpose?

The jury, after being absent for about three quarters of an hour, returned into court, when the foreman stated that they answered all the questions affirmatively, or in favor of the plaintiff.

His Lordship then directed the verdict to be entered for the plaintiff, with leave to the defendant to move to enter the verdict for himself, if the Court above should be of opinion that the combination of the "clutch-box" and the "brake" was the patent, and that the use of the brake alone was no infringement of it.

LIST OF REGISTRATIONS EFFECTED UNDER THE ACT FOR PROTECTING NEW AND ORIGINAL DESIGNS FOR ARTICLES OF UTILITY.

1849.

July 30. *Sabina de Caulier,* of 42, Coleman-street, City, for an ottoman and cradle, called the "ottoman cradle."

30. *Miller & Co.*, of 370, Oxford-street, for a bed-side or other table.

30. *George West,* of Ricarton, Linlithgow, for a tile machine.

Aug. 1. *Robert William Wright,* of No. 39, Devonshire-street, Queen-square, London, for a compound signet and keeper ring.

2. *Theresa Lawrence,* of Ludgate-hill, City of London, for the "lady's belt," with elastic ligature attached; adapted also for other purposes.

2. *Robert Frederick Miller,* of Mansion House, Hammersmith, for an improved omnibus.

4. *W. & S. Butcher,* of 11, Clare-street, Bristol, ironmongers, for self-fixing laths of iron to metallic bedsteads, sofas, couches, &c.

4. *Sydney Smith,* of Willenhall, for a lock.

6. *Samuel Denison,* of Harwood-street, Leeds, for a machine for stretching woven fabrics.

7. *John Roe,* of West Bromwich, for a horse-shoe.

8. *John Walker,* of 48, Shoe-lane, London, builder, for an effluvia-trap for sewers and water-closets.

9. *Thomas James Tasker,* of No. 14, Great Dover-street, Borough, for the "resilient shirt-collar fastener."

9. *John Roberts,* of 34, Eastcheap, in the City of London, spice merchant, for an improved strawberry tile.

9. *Thomas Waller,* of 19, Wimborne-street, Hoxton, ironmonger, for a fire-lump stove.

10. *Charles Pinnell,* of 1, Trellick-terrace, Vauxhall-road, Pimlico, for a self-protecting letter-box.

11. *Benjamin Frederick Atkinson,* of 26, Strand, Middlesex, surgical instrument-maker, for an anal truss or rectum supporter.

11. *J. Sparkes Hall,* of 308, Regent-street, London, for the "Victoria and Albert elastic gaiter."

11. *John James,* of 112, Bishopsgate-street Within, City of London, for a non-evaporating self-cleansing water-trap.

Aug. 14. *William Whitehurst & Co.*, of 313, Oxford-street, London, carriage-builders, for a graduated carriage-spring.

14. *Jennens, Bettridge, & Sons*, of Halkin-street West, Belgrave-square, London, and Constitution-hill, Birmingham, for a writing folio desk.

14. *Thomas Green*, of Birmingham, for a set of metallic fittings and variators for lasts and boot-trees, and shoe-cleaners.

15. *Jean François Isidor Caplin*, of 58, Berners-street, for Hygeian or corporiform corsets.

15. *Bernhard Samuelson*, of Banbury, Oxford, for parts of apparatus for cutting turnips and other roots.

15. *Richard Reed Rapson*, of Penryn, in the county of Cornwall, for apparatus for dressing flour, &c.

16. *Henry Mc Evoy*, of Birmingham, manufacturer, for parts of collars.

16. *Christopher Carney*, of county Kildare, for an improved thrashing-machine.

16. *Mappleback & Lowe*, of Birmingham, for a fire-grate.

20. *William Neufville Martin*, of 86, Newman-street, for an improved flower-pot case.

21. *Francis Taylor*, of Romsey, Hampshire, surgeon, for a nipple protector.

21. *John Warner & Sons*, of 8, Crescent, Jewin-street, for an improved solar lamp.

21. *Job Clark & Richard Sidebotham*, of Willenhall, for a design for stamping machinery.

21. *George Edward White & William White*, of Hartley Row, Hants, builders and decorators, for a ventilating brick.

22. *Stephen Carlton*, of 14, Priestgate, Darlington, for a two or four-wheeled carriage-spring.

23. *John Cordingly*, of Ipswich, Suffolk, for a bathing-boat.

23. *George Babb*, of 346, Strand, London, for the "D'Oyley coat sleeve."

23. *T. W. Ingram*, of Bradford-street, Birmingham, button manufacturer, for a self-calculating steelyard.

24. *Thomas Melling*, of Rainhill Iron Works, near Liverpool, engineer, for an improved double-sash window.

24. *William Crane Wilkins*, of 24, Long Acre, London, for an improved spring weighing-machine.

27. *Rigby & Duckrell*, of 1, Vauxhall-walk, next the Gardens, chemical light manufacturers, for the "monastic escritoire slot slide wax vesta and chemical light-box."

28. *George Aldred*, of Primrose-street, Bishopsgate-street, London, for a spindle and spring for a looking-glass.

List of Patents

That have passed the Great Seal of IRELAND, from the 17th July to the 17th August, 1849, inclusive.

To Thomas Robinson, of Leeds, in the county of York, flax dresser, for improvements in machinery for breaking, scutching, cutting, hackling, dressing, combing, carding, drawing, roving, spinning, and doubling flax, hemp, tow, wool, silk, and other fibrous substances, and in uniting fibrous substances.—Sealed 7th August.

John Edward Hawkins Payne, of Great Queen-street, in the county of Middlesex, coach-lace manufacturer, and Henry William Currie, engineer, in the employ of the said John Edward Hawkins Payne, for improvements in the manufacture of coach-lace and other similar looped or cut-pile fabrics.—Sealed 7th August.

List of Patents

Granted for SCOTLAND, subsequent to July 22nd, 1849.

To James White, of Lambeth, civil engineer, for improvements in machines or apparatus for sowing seeds.—Sealed 25th July.

James Green Gibson, of Ardwick, near Manchester, machinist, for certain improvements in machines used for preparing to be spun and spinning cotton and other fibrous substances, and for preparing to be woven and weaving such substances when spun.—Sealed 30th July.

Andrew Peddie How, of the United States, but now residing at Basinghall-street, London, engineer, for an instrument or instruments for ascertaining the saltness of water in boilers,—being a communication.—Sealed 1st August.

Hugh Lee Pattinson, of Washington House, Gateshead, Durham, chemical manufacturer, for improvements in manufacturing a certain compound or certain compounds of lead, and the application of a certain compound or certain compounds of lead to various useful purposes.—Sealed 6th August.

Amedee François Remond, of Birmingham, for improvements in machinery for folding envelopes, and in the manufacture of envelopes.—Sealed 6th August.

Richard Kemsley Day, of Stratford, hydrofuse manufacturer, for improvements in the manufacture of emery paper, emery cloth, and other scouring fabrics.—Sealed 7th August.

John Thom, of Ardwick, near Manchester, calico printer, for improvements in cleansing, scouring, or bleaching silk, woollen, cotton, and other woven fabrics and yarns, and in ageing fabrics and yarns when printed.—Sealed 7th August.

Joseph Findlay, of New Sneddon-street, Paisley, manufacturer, and Andrew Wilkie, of Paisley, turner, for an improvement or improvements in machinery or apparatus for turning, cutting, shaping, or reducing wood or other substances.—Sealed 10th August.

James Thomson Wilson, of Middlesex, chemist, for improvements in the manufacture of sulphuric acid and alum.—Sealed 15th August.

Edward Lord, of Todmorden, in the county of Lancaster, machinist, for certain improvements in machinery or apparatus applicable to the preparation of cotton and other fibrous substances.—Sealed 15th August.

Pierre Armand le Comte de Fontainemoreau, of No. 4, South-street, Finsbury, for certain improvements in weaving,—being a communication.—Sealed 22nd August.

New Patents

SEALED IN ENGLAND.

To George Fellows Harrington, of Portsmouth, dentist, for improvements in the manufacture of artificial teeth, and the beds and palates for teeth. Sealed 1st August—6 months for inrolment.

Florentin Joseph de Cavaillon, of Paris, chemist, for certain improvements in obtaining carbonated hydrogen gas, and in applying the products resulting therefrom to various useful purposes. Sealed 1st August—6 months for inrolment.

Eugene Alexandre Desire Boucher, of Paris, metal merchant, for certain improvements in the manufacture of cards. Sealed 1st August—6 months for inrolment.

Jerome Andre Drieu, of Manchester, machinist, for certain improvements in the manufacture of wearing apparel, and in the machinery or apparatus connected therewith. Sealed 1st August—6 months for inrolment.

William Geeves, of Battle-bridge, in the county of Middlesex, saw mill proprietor, for improvements in the manufacture of boxes for matches and other purposes. Sealed 1st August—6 months for inrolment.

Benjamin Thompson, of Newcastle-upon-Tyne, civil engineer, for improvements in the manufacture of iron. Sealed 1st August —6 months for inrolment.

Thomas Potts, of Birmingham, manufacturer, for improvements in apparatus used with curtains, blinds, maps, and plans. Sealed 1st August—6 months for inrolment.

Julian Edward Disbrowe Rodgers, of High-street, Pimlico, Professor of Chemistry, for improvements in the manufacture of white lead,—being a communication. Sealed 1st August—6 months for inrolment.

David Harcourt, of Birmingham, machinist, for improvements in vices, and in the manufacture of hinges; and also in apparatus for dressing and finishing articles made of metal. Sealed 1st August—6 months for inrolment.

Adam Yule, of Dundee, master mariner, and John Chanter, of Lloyd's, London, Gent., for improvements in the preparation of materials for coating ships and other vessels. Sealed 1st August—6 months for inrolment.

Richard Kemsley Day, of Stratford, hydrofuse manufacturer, for improvements in the manufacture of emery paper, emery cloth, and other scouring fabrics. Sealed 1st August—6 months for inrolment.

John Shaw, of Glossop, in the county of Derby, musical instrument maker, for certain improvements in air guns. Sealed 1st August—6 months for inrolment.

Augustus Roehn, of Paris, in the Republic of France, Gent., for improvements in making roads and ways, and in covering the floors of court-yards, buildings, and other similar places. Sealed 1st August—6 months for inrolment.

James Murdoch, of Staple Inn, in the county of Middlesex, mechanical draughtsman, for certain improvements in converting sea water into fresh, and in ventilating ships and other vessels; applicable also to the evaporation of liquids, and to the concentration and crystallization of syrups and saline solutions,—being a communication. Sealed 1st August—6 months for inrolment.

John Parkinson, of Bury, in the county of Lancaster, brass founder, for improvements in machinery or apparatus for measuring and registering the flow of liquids. Sealed 1st August—6 months for inrolment.

Benjamin Aingworth, of Birmingham, button maker, for improvements in ornamenting iron and other metals for use in the manufacturing of gun-barrels and all other articles to which the same ornamented metals may be applied. Sealed 1st August—6 months for inrolment.

David Clovis Knab, of Leicester-place, Middlesex, civil engineer, for an improved apparatus for distilling fatty and oily matters. Sealed 1st August—6 months for inrolment.

Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, mechanical draughtsman, for improvements in derricks for raising heavy bodies,—being a communication. Sealed 9th August—6 months for inrolment.

William Furness, of Lawton-street, Liverpool, builder, for improvements in machinery for cutting, tenoning, planing, moulding, dovetailing, boring, mortising, tonging, grooving, and sawing wood; also for sharpening and grinding tools or surfaces; and also in welding steel to cast-iron. Sealed 9th August —6 months for inrolment.

William Thomas, of Cheapside, merchant, and John Marsh, foreman to the said William Thomas, for improvements in the manufacture of looped fabrics, stays, and other parts of dress; also in apparatus for measuring,—being partly a communication. Sealed 9th August—6 months for inrolment.

Arthur Howe Holdsworth, of the Beacon, Dartmouth, Esq., for improvements in the construction of marine boilers and funnels of steam-boats and vessels. Sealed 9th August—6 months for inrolment.

Thomas John Knowlys, of Heysham Tower, near Lancaster, Esq., for improvements in the application and combination of mineral and vegetable products; also in obtaining products from mineral and vegetable substances, and in the generation and application of heat. Sealed 9th August—6 months for inrolment.

John Ruthven, of the City of Edinburgh, civil engineer, for improvements in propelling and navigating ships, vessels, or boats, by steam and other powers,—being a communication. Sealed 10th August—6 months for inrolment.

Arthur Dunn, of Worcester, soap-maker, for improvements in marking soap. Sealed 16th August—6 months for inrolment.

Frederick William Bodmer, of Paris, civil engineer, for certain improvements in machinery or apparatus for letter-press printing. Sealed 16th August—6 months for inrolment.

Richard Archibald Brooman, of the Firm of J. C. Robertson & Co., for improvements in machinery, apparatus, and processes, for extracting, depurating, forming, drying, and evaporating substances,—being a communication. Sealed 16th August—6 months for inrolment.

Jonathan Blake, of Mount Pleasant, Eaton, in the City of Norwich, surgeon, for certain improvements in lamps. Sealed 16th August—6 months for inrolment.

James Young, of Manchester, manufacturing chemist, for improvements in the treatment of certain ores and other matters containing metals, and in obtaining products therefrom. Sealed 16th August—6 months for inrolment.

Louis Lemaitre, of Paris, engineer, for improvements in the manufacture of ferrules, for fixing the tubes of locomotive and other boilers. Sealed 16th August—6 months for inrolment.

Charles Cowper, of Southampton Buildings, Middlesex, for improvements in machinery for raising and lowering weights and persons in mines, and in the arrangement and construction of steam-engines, employed to put in motion such machinery; part of which improvements are applicable to steam-engines generally,—being a communication. Sealed 23rd August—6 months for inrolment.

Frederick Chamier, of Warwick-street, Middlesex, Commander in the Royal Navy, for improvements in the manufacture of ships' blocks,—being a communication. Sealed 23rd August—6 months for inrolment.

William Edward Newton, of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, civil engineer, for certain improvements in steam-boilers,—being a communication. Sealed 23rd August—6 months for inrolment.

Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, mechanical draughtsman, for improvements in manufacturing and refining sugar,—being a communication. Sealed 23d August—6 months for inrolment.

Malcolm Macfarlane, of Thistle-street, Glasgow, North Britain, coppersmith, for certain improvements in machinery or apparatus for the drying and finishing of woven fabrics. Sealed 30th August—6 months for inrolment.

Thomas Symes Prideaux, of Southampton, Gent., for improvements in puddling and other furnaces, and in steam-boilers. Sealed 30th August—6 months for inrolment.

James Robinson, of Huddersfield, orchil and cudbear manufacturer, for improvements in preparing or manufacturing orchil and cudbear. Sealed 30th August—6 months for inrolment.

Isidore Bertrand, of France, engineer, for an improvement in protecting persons and property from accident in carriages. Sealed 30th August—6 months for inrolment.

Onesiphore Pecqueur, of Paris, civil engineer, for certain improvements in the manufacturing of fishing and other nets. Sealed 30th August—6 months for inrolment.

A grant of an extension for the term of five years from the 23rd of October, 1849, of a patent to George Baxter, of Charter-house-square, Middlesex, engraver, for his invention of improvements in producing colored steel-plate, copper-plate, and other impressions.

Charles Morey, citizen of the United States of America, now residing at Manchester, Gent., for certain improvements in machinery or apparatus for sewing embroidery, and uniting or ornamenting, by stitches, various descriptions of textile fabrics. Sealed 30th August—6 months for inrolment.

Disclaimers and Amendments
OF PARTS OF INVENTIONS
MADE UNDER LORD BROUGHAM'S ACT.

Disclaimer, filed with the Clerk of the Patents for England, on the 7th July, 1849, to part of the title of a patent granted to William Mac Bride, the younger, of Sligo, in the Kingdom of Ireland, for an invention of "improvements in the apparatus and process for converting salt water into fresh water, and in oxygenating water;" bearing date, at Westminster, the 2nd of April, 1849, whereby he disclaims the words "*oxygenating water.*"

Disclaimer, filed with the Clerk of the Patents for England, on the 16th July, 1849, to part of the title of a patent granted to Anthony Barberis, of Mondovi, but now of Leicester-square, in the county of Middlesex, engineer, for "improvements in spinning silk, and in the construction of swifts, and in the arrangement of apparatus for winding silk and other fibrous substances;" bearing date, at Westminster, the 16th day of January, 1849, whereby he disclaims the words "*in spinning silk and.*"

Disclaimer, filed with the Clerk of the Patents for England, on the 23rd July, 1849, to part of the title of a patent granted to Thomas Robinson, of Leeds, in the county of York, flax-dresser, for his invention of "improvements in machinery for breaking, scutching, cutting, hackling, dressing, combing, carding, drawing, roving, and spinning flax, hemp, tow, wool, silk, and other fibrous substances, and in uniting fibrous substances;" bearing date, at Westminster, the 23rd day of January, 1849, whereby he disclaims the word "*carding,*" and the words "*and in uniting fibrous substances.*"

Disclaimer, filed with the Clerk of the Patents for England, on the 25th July, 1849, to part of the title of a patent granted to John Taylor, of 22, Parliament-street, Westminster, architect, for "an improved mode of constructing and fencing walls;" bearing date, at Westminster, the 8th day of February, 1849, whereby he disclaims the words "*and fencing.*"

Disclaimer, filed with the Clerk of the Patents for England, on the 8th day of August, 1849, to part of the title of a patent granted to Henry Fisher, of Upholland, Lancaster, Gent., for his invention of "certain improvements in coke-ovens, and in machinery and apparatus for working the same or connected therewith; and a mode or modes of applying certain portions of coke, or the residual products of coke, to heating and lighting;" bearing date, at Westminster, the 8th day of February, 1849, whereby he disclaims the words "*a mode or modes of applying certain portions of coke, or the residual products of coke, to heating and lighting.*"

Disclaimer, filed with the Clerk of the Patents for England, on the 20th August, 1849, to part of the title and specification of a patent granted to Joseph Howard, of Manchester, for "certain improvements in the manufacture of silk plushes, silk velvets, worsted and other plushes;" bearing date the 24th day of February, 1845.

CELESTIAL PHENOMENA FOR SEPTEMBER, 1849.

D.	H.	M.	
1			Clock after the ☉ 0m. 10s.
—			☽ rises 6h. 19m. A.
—			☽ passes mer. 11h. 26m. A.
—			☽ sets 3h. 33m. M.
	9	8	Juno in conj. with the ☉
2	5	18	Ecliptic oppo. or ○ full moon
3			Occul. 27 Piscium, im. 10h. 28m. em. 11h. 12m.
—			Occul. 29 Piscium, im. 12h. 26m. em. 13h. 40m.
4	4	43	♄ in conj. with the ☽ diff. of dec. 0. 18. N.
5			Clock after the ☉ 1m. 27s.
—			☽ rises 8h. 5m. A.
—			☽ passes mer. 1h. 50m. M.
—			☽ sets 8h. 13m. M.
—			Occul. υ Piscium, im. 10h. 32m. em. 11h. 11m.
6			Occul. B.A.C. 845, im. 15h. 42m. em. 16h. 46m.
7	5	48	☿ in the descending node
—			Occul. *f* Tauri, im. 10h. 36m. em. 11h. 31m.
8			Occul. 71 Tauri, im. 10h. 1m. em. 10h. 47m.
—			Occul. θ^2 Tauri, im. 11h. 10m. em. 11h. 37m.
—			Occul. 80 Tauri, im. 11h. 27m. em. 12h. 21m.
—			Occul. 81 Tauri, im. 11h. 41m. em. 12h. 36m.
—			Occul. 85 Tauri, im. 12h. 13m. em. 13h. 13m.
9			Occul. 111 Tauri, im. 9h. 52m. em. 10h. 35m.
—			Occul. 117 Tauri, im. 11h. 10m. em. 11h. 58m.
	6	43	♂ in conj. with the ☽ diff. of dec. 4. 27. N.
9	6	55	☽ in □ or last quarter
	23	33	♂ in □ with the ☉
10			Clock after the ☉ 3m. 9s.
—			☽ rises 11h. 17m. A.
—			☽ passes mer. 6h. 17m. M.
—			☽ sets 2h. 13m. A.
	22	0	☽ in Perigee
12	20	26	Pallas in □ with the ☉
13	3	26	♀ in conj. with the ☽ diff. of dec. 1. 44. N.
15			Clock after the ☉ 4m. 53s.

D.	H.	M.	
15			☽ rises 3h. 53m. M.
—			☽ passes mer. 10h. 59m. M.
—			☽ sets 5h. 51m. A.
		5	♃ in conj. with the ☽ diff. of dec. 0. 32. N.
16	4	2	Ecliptic conj. or ● new moon
17	9	28	☿ in Aphelion
	20	8	♀ in the ascending node
	21	5	☿ in conj. with the ☽ diff. of dec. 5. 24. S.
18			Mercury R. A. 13h. 6m. dec. 8. 35. S.
—			Venus R. A. 9h. 17m. dec. 15. 49. N.
—			Mars R. A. 5h. 23m. dec. 22. 42. N.
—			Vesta R. A. 7h. 4m. dec. 20. 19. N.
—			Juno R. A. 11h. 7m. dec. 4. 10. N.
—			Pallas R. A. 17h. 31m. dec. 10. 54. N.
—			Ceres R. A. 18h. 10m. dec. 29. 37. S.
—			Jupiter R. A. 10h. 15m. dec. 11. 47. N.
—			Saturn R. A. 0h. 23m. dec. 0. 19. S.
—			Georg. R. A. 1h. 12m. dec. 7. 5. N.
—			Mercury passes mer. 1h. 17m.
—			Venus passes mer. 21h. 29m.
—			Mars passes mer. 17h. 23m.
—			Jupiter passes mer. 9h. 22m.
—			Saturn passes mer. 12h. 32m.
—			Georg. passes mer. 13h. 43m.
20			Clock after the ☉ 6m. 38s.
—			☽ rises 9h. 47m. M.
—			☽ passes mer. 2h. 58m. A.
—			☽ sets 8h. 2m. A.
22	16	3	☉ enters Libra, Autumn com.
23	18	0	☽ in Apogee
24	11	24	☽ in □ or first quarter
25			Clock after the ☉ 8m. 22s.
—			☽ rises 2h. 29m. A.
—			☽ passes mer. 6h. 53m. A.
—			☽ sets 11h. 20m. A.
	17	8	♃'s first sat. will im.
26	10	43	Ceres in □ with the ☉
27	7		♄ in oppo. to the ☉
29	23	56	☿ greatest elong. 25. 37. E.

The Satellites of Jupiter are not visible until the 23d day of this month, being too near the Sun.

J. LEWTHWAITE, Rotherhithe.

THE
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No. CCXIV.

RECENT PATENTS.

To Thomas Spencer, *of Prescot, in the county of Lancaster, earthenware manufacturer, for certain improvements in machinery or apparatus for manufacturing pipes or tubes from clay or other plastic materials; part or parts of which improvements are applicable to the manufacture of hollow earthenware.*—[Sealed 10th April, 1848.]

These improvements consist, firstly,—in the arrangement and construction of machinery or apparatus wherein the direct action of steam pressure may be employed for the purpose of manufacturing pipes or tubes, or other hollow earthenware; secondly,—in the method of forming such pipes or tubes or other hollow earthenware with socket or flange ends attached (for the purpose of more conveniently joining them into continuous lengths), by means of a suitable construction of die or dies, adapted to such purpose, and employed in connection with the pressing machinery; also in the method of forming any description of goods in the manufacture of which the inside or lower die is withdrawn or the dies are separated,—always premising that pipes or tubes are delivered head or socket first; thirdly,—in certain improved apparatus for turning over the pipes or tubes, or other vessels, when of large dimensions, after the first part of the process of manufacture; and also the use of a drum or mandril for giving internal support to pipes or tubes (whether with or without sockets) whilst being expressed from the material cylinder, in combination with a sliding ring when the tube is made with a socket; fourthly,—in the method of forming or turning curves or bends in such pipes or tubes, of whatever form, shape, or configuration they may be required; fifthly,—in the method of forming or making "stilts and feet," and burning the tubes or pipes thereon; and, lastly,—in the peculiar construction of the kiln employed for burning the pipes and tubes, and other hollow earthenware.

In Plate VII., fig. 1, represents, in front elevation, the improved machinery or apparatus employed in the manufacture of earthenware pipes or tubes, with a socket-die attached; fig. 2, is a transverse section of the same; fig. 3, is a plan view of the improved die, so far as is additional; fig. 4, represents, in sectional elevation, the material cylinder, having dies attached thereto suitable for manufacturing an earthenware "crock;" and also a carriage for carrying the socket core-pin or inside conformation of other vessels, having represented upon it a crock core-pin; and fig. 5, is a plan view of the same: fig. 6, represents the elevation of a cramp or holder, used for turning the pipes or tubes (when of larger dimensions) or other vessels, after the first process of manufacture is passed; and also a section of the drum or mandril, used for keeping the pipe straight and causing it to retain a circular or other required form. In figs. 1, and 2, *a, a,* represent two transverse beams or pieces of timber, used as a frame for supporting the steam-cylinder *b, b;* into this cylinder is fitted a steam-tight piston *c, c,* to which is firmly attached one end of the piston-rod *d, d,* which works through the steam-tight stuffing-box *e, e.* To the other end of this rod is attached another piston *f, f,* which is used for pressing the clay (or other plastic material of which the pipe or other vessel is made) out of the lower or material cylinder *g, g,* which can be turned outwards upon its journals or bearings, to be charged with clay or other materials. *h,* is the "dod" or die. *i, i,* represents the outside case or mould, for forming the outside of the socket of a tube or a vessel: it is worked in the slides *k, k,* by means of the lever *l, l. m,* is the core-pin, which forms the inside of the socket, and is attached to the core of the dod or die *h, h,* (through which the pipe is expressed) by a screw or otherwise. The spaces *z, z,* betwixt the outside mould and the core-pin must be always made of the precise dimensions which the socket of the pipe or the size of the vessel is required to be. *n, n,* are passages, for the admission and exit of steam to and from the cylinder *b, b. o, o,* is a slide-valve, used for the same purpose and in the manner of the ordinary steam slide-valve; and it is worked by means of the levers *p, p.* *r, r,* is the pipe for conveying steam from the boiler to the steam-box *s, s.* *t, t,* is the exit-pipe for the steam after it has performed its office. *u, u,* are two steps or blocks, fitted into the cross-head *v, v;* these blocks clasp the piston-rod *d, d,* and are pressed together by the cam *w, w,* which is worked by the lever *x, x.* The use of this brake is merely to restrain the descent of the piston at will, and to prevent accidents. At fig. 4, A, is a guide-plate, bolted firmly to the floor of the room, and sustaining the core-pin carriage B, B. This carriage carries a core-pin *m, m,* used in the manufacture of hollow earthenware; which core-pin is raised or lowered from its position by means of the screw D, D, and nut E, E; and this nut is worked by means of the wheel F, F, and the handle G, G. At fig. 6, H, represents a cramp or holder, fastened to the wall by a plate and bolts, and secured to the plate in the centre by means of the round stud-pin L, L, on which it is made to work freely. M, is a drum or mandril, placed inside the pipe when it is being expressed from the material cylinder. N, is a sliding ring, the outside of which is made to fit the inside of the socket of pipe C, C, as shewn in section, and fits loosely on the outside of the drum when the pipe is being made: this ring is placed inside the socket and slides down the drum,—thus preserving the socket in its proper form. P, P, are boards, placed at each end of the drum, to prevent the pipe from sliding off it when handled or turned over. R, R, are the screws, working through the ends of the cramp (which are screwed to receive them), and are for the purpose of securely holding the pipe whilst it is being turned over.

In manufacturing a pipe or tube, the cylinder *g, g,* is first filled with clay or other plastic material; the core-pin *m, m,* is then inserted and secured to the core of the die *h, h;* and the outside mould *i, i,* is closed. The slide-valve *o, o,* is now opened, by means of the levers *p, p,* (as before described) to admit steam from the steam-box to the top side of the piston. By the elastic force of the steam the piston *e, e,* is depressed, and the piston *f, f,* is forced down into the material, of which the pipe or vessel is to be formed, with a power corresponding to the pressure of the steam. This pressure is continued until the space *z, z,* left betwixt the core-pin and the outside mould is completely filled; but when the socket of the tube has thus been formed, the slide-valve is raised by the means used for the admission of steam; and the steam which has been used for pressure is exhausted from the top of the piston, and passes into the atmosphere through the exit-pipe *t, t.* The next thing is to open the outside socket-mould, by means of the levers *l, l,* and withdraw the inside core-pin, whereby the socket is left protruding through the upper die *h.* The top side of a drum, similar to that shewn at fig. 6, but of a suitable size, is placed underneath the core of the die *h*; and beneath this is placed the board P,—the whole being supported by means of a carriage working on a guide-plate A. Into the socket of the tube the sliding ring N, is inserted, and steam is again caused to press on the piston. By this means the clay is forced through the die *h,* and the sliding ring is carried down over the drum M, until the pipe or tube is made of sufficient length, when it is severed by means of a wire or knife. Tubes, when made of small diameter, may then be turned over by hand; but when made of a larger calibre they require to be turned over by a machine; in which case the tube, with the board underneath it (the sliding ring still remaining), is placed in the cramp or holder H, with the socket downwards, as shewn in the drawing. On the top of this drum or mandril a second board is placed; and, by working the screws R, R, the drum is firmly held in the cramp. The holder (which is made capable of revolving on the stud-pin L,) is next turned, until the socket is brought to the top; the screw is then slackened, and the whole is removed from the cramp and placed on the floor with the socket upwards; the sliding ring and drum are then withdrawn, and the tube or vessel is left erect in a finished state; and the manufacture is complete in that stage. The bends and curves are made in the same way, being directed to the required form either with or without curved drums. The dies or moulds for forming hollow earthenware are made and worked in the same manner as the moulds above described for making the sockets of tubes or pipes, excepting that the inside core-pin is placed at such a distance from the under side of the die as is sufficient for the thickness of the bottom of such articles, as represented at fig. 4.

The kiln which the patentee employs for burning is circular, and of a similar kind to those in general use, built with "goits and bags." The improvement consists in building arches from bag to bag, which may or may not be extended with the arches towards the centre of the kiln, and so covering either the whole or any part of the kiln in an intermediate space between the bottom of the kiln and the usual top arch; or it may be done by one arch only, forming thereby a second bottom, securing a firm standing for the tubes or other arches; which arches may be repeated, or placed one set above another.

The patentee, in conclusion, states that he does not restrict himself to the use of such a press as described, or to other details, excepting so far as regards the peculiar construction of the dies for the continuous formation of the sockets and the tube or vessel; as he is aware that other modes of pressure are in use for the construction of pipes, and might be applied for the purposes herein described; and other modes of drawing off the outside moulds for forming the sockets and forming the hollow earthenware, &c., may be adopted; but their adoption, with the insertion of the inside conformation or core-pin, is absolutely necessary; and also that there must be an outside die, such or somewhat similar to those described, either to draw off, to turn round, or to remain stationary, at discretion, and, when together, either closed at the bottom, or open, or partially so. In all cases the inside conformation of the socket, flange, or vessel, must be removed after forming the socket, flange, or vessel, when the vessel is constructed, or the pipe continues to come out of the required diameter, or the vessel of its proper size; or all may be removed at once and separated afterwards. The socket may be made with the pipe, or the socket may be made separately and attached afterwards. The "stilts" or feet for burning are made upon the same shape, or thereabouts, as the vessel or tube itself, with or without air-holes (the former is preferred) for the admission of draft and the better promotion of burning and glazing.

A further improvement consists in the grinding of earthenware pipes; as also turning and boring them.

The patentee claims, First,—the application of the direct action of steam pressure upon clay and other plastic materials, for the purpose of manufacturing pipes or tubes or other hollow earthenware, or vessels or tubes of other plastic materials, by the use or employment of the machinery or apparatus above described and exhibited in the drawings, or other suitable modification of such arrangement, having the dies (whether of the ordinary kind or of the peculiar construction above described) for forming the sockets placed underneath the material cylinder, as shewn at figs. 1, 2, and 4. Secondly,—the peculiar construction of die or dies, for forming pipes of clay or other plastic materials with a socket (the socket being formed prior to the remainder of the tube), and for the construction of hollow earthenware, or vessels or tubes of other plastic materials. Thirdly,—the mechanism for turning over the pipes as described; and also the use of the core-drum or mandril, for giving internal support to pipes or tubes (whether with or without sockets) whilst being expressed from the material cylinder, in combination with the sliding ring, when the tube is made with a socket, as best seen at fig. 6. Fourthly,—the construction of bends and curves in pipes or tubes, as described (either with or without drums or mandrils), direct from the material cylinder. Lastly,—the method of forming or making stilts and "feet," for burning upon; and also the peculiar construction of kiln, as above described.—[*Inrolled October*, 1848.]

To Alfred Vincent Newton, *of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, mechanical draughtsman, for improvements in casting printing types and other similar raised surfaces, and also in casting quadrats and spaces,—being a communication.*—[Sealed 16th December, 1848.]

This invention is designed, in the first place, to regulate the supply of the molten metal to the mould and matrix or die, so as to avoid any excess of metal for each casting; and, secondly, to produce castings of greater accuracy of form and at a superior speed than heretofore, by means of mechanism admitting of nice adjustments of the working parts.

The supply of molten metal for each casting is regulated by means of a particular form of piston or plunger (hereafter to be described), working in a cylinder in the metal pot; which piston or plunger has a hollow space formed in its centre and extending its whole depth, along which the molten metal passes, and escapes through a valve at the lower end thereof into a chamber underneath the piston. By the downward action of the piston the molten metal is forced through the orifice or nipple into the mould and matrix, which is brought immediately over the nipple; and thus the type or other raised surface, quadrat, or space, used for printing purposes, is formed. The mode of bringing up the mould and matrix, so as to cause them to occupy the right position for receiving the proper quantity of metal for each successive casting, will be hereafter particularly described.

The mechanism by which the castings are effected consists of a pair of jaws, for containing the two halves of the mould; one of which jaws is moveable on a centre, so as alternately to close and open, and thereby to be fitted alternately to receive the molten metal and admit of its being discharged in the form of a type, quadrat, or space, as required. This moveable jaw is made to work uniformly to any given point of adjustment (according to the dimensions and character of the casting required to be produced) by means of a tension-bar, which is also capable of adjustment, as to its length, by means of a double screw, as hereafter described. This bar is likewise so fitted to the machine as to be capable of having its position readily changed when required. A further end answered by this bar is the action produced by it upon the lever or mechanism for effecting the liberation of the form of type when cast.

Another material part of this machine is the lever or mechanism which is made to press upon one end of the matrix and tilt it, so as to withdraw it from the metal within the mould at the same period as above, viz., just after the casting has taken place, and during the elevation of the jaws or arms.

In Plate VIII., fig. 1, represents a plan view of the machine, with the mould attached, and the matrix therein at rest, complete, and in working condition; fig. 2, is a front elevation of the machine; fig. 3, is a side elevation at the left-hand of the machine; fig. 4, is a side elevation at the right-hand of the machine; fig. 5, is a back elevation of the machine; fig. 6, is an inverted plan of part of the upper surface of the machine; fig. 7, shews, on an enlarged scale, a section of the pot for the metal and the piston; and fig. 8, is a plan of the pot for the metal. A, A, represents the surface of a table, on which the machine is planted; and B, B, (figs. 3, and 4,) are regulating screws, with adjusting nuts and bolts, which secure to the table the moveable platform D, D, through which pass four levelling screws 1, 1, the ends of which rest on the bed-pieces C, C. E, F, (fig. 2,) are side posts, cast on or secured to the platform D; and G, is a shaft, centred at its ends, and turning on central adjusting screws in the heads of the side posts E, F. On this shaft G, is secured, by a pinching screw, the arm H; and on the same shaft the fork P, P, is secured by a screw. This fork supports, by centre screws, the opening arm I. In the extremities of the arms H, I, (see fig. 1,) sockets of about three inches long and three quarters of an inch in diameter are drilled. 13, 14, are two pieces of steel, about six inches long, three quarters of an inch broad, and one inch deep—about three inches of which are turned, and are slidden into the sockets of the arms H, I. These pieces, so fitted, are called slide-arms, and are held in their places by the pinching screws 15, 15. To each back plate of the type-mould 16, 17, is secured a piece of iron 18, of the length of the said plate, and about three quarters of an inch broad by one inch deep; and these again are secured to the slide-arms 13, 14, by the screws 19, 19. On the post F, is secured a swivel-socket 2, through which passes a pin, formed on the end of a coupling tension-rod Q, and is held in its place by the spring 3, attached to the socket 2. This rod Q, is composed of a right and left-hand screw, with a regulating box in the centre and two jam-nuts. The other end of the said rod moves in a fixed socket in the projection 4, on the side of the arm I, and is prevented from being drawn out by a nut on the end of it. Y, is a tilting lever, having its fulcrum in a stud 20, on the arm H; the hooked end of the said lever works over the antifriction-roller 21, on the stay 44, fixed by adjusting screws to the post E; and at its other end the lever Y, is slotted, to receive an adjusting screw for attaching the piece of iron 22, to the lever Y. This piece of iron is, at its extreme end, bent to a right angle, and receives a regulating screw 45, for the purpose of tilting the matrix 41. This piece of iron 22, can be shifted as required. The action of the tilting lever Y, is regulated by the rising and falling of the arm H. Z, is a pushing lever, having its fulcrum at 26, on the arm H; and to the other end 29, of this lever (see fig. 3,) a staple 30, is attached by a regulating screw. At each end of the staple, attached by screws, is an ejecter or pusher 31, which works across the face and jet of part of the mould 16, on the arm H. On the under and upper side of the arm H, are fixed, by regulating screws, two guides 33, 33, for the purpose of directing and keeping the pushers in their places. The working of the pushing lever Z, is entirely dependent on the movement of the opening arm I, which is connected with the lever Z, by means of a rod 27, formed of two pieces of iron, lying one above the other, but held together by two regulating screws. This connecting-rod is attached to the arm I, by a pin, and held in its place by the spring 28, also secured to the arm I. The other end of this rod 27, is secured to the pushing lever Z, by the screw 32. 23, is a curved spring, one end of which is fixed by a screw to the under side of the slide-arm 13, and the other end presses the matrix 41, close down to the face of the mould, at the time that the metal is being injected into the aperture of the mould; and which spring still retains its place on the matrix, although pressed upwards by the working of the tilting lever Y, during the elevation of the arm H; but, as the arm descends, the power of the tilting lever is removed, and the spring 23, again causes the matrix to resume its former position on the face of the mould. Between the arm H, and fork P, both on the shaft G, (see fig. 2,) is a loose collar W; and 37, is a connecting-pin, passing through the collar W, and the shaft G, for securing the two together. On the collar W, the arm J, is fixed by the screw 38. Below the shaft G, and parallel thereto, is the shaft K, which revolves in journals on the pillars 39, 39, fixed to or cast upon the platform D. To the end of the shaft K, is attached the handle L; and mounted on the same shaft is the double wiper M, for giving two different movements: it is fixed to the shaft K, by the screw 42, which is for adjusting the wiper, that either of its cam surfaces may act upon the antifriction-roller 36. On the other end of the shaft K, is an arm N, slotted, to receive a bolt, which forms the axle of an antifriction-roller 40. This roller works in the excentric opening or slot, formed in the segment O, O, attached by adjusting screws to the arm J, (see fig. 3,) and completes the connection between the lower and upper parts of the machine. By turning the handle L, the arm J, elevates and depresses the arms H, I, the movements of which work all the other appendages of the upper part of the machine which are attached to these arms. 6, 7, are side posts of an iron frame, the feet of which are secured by screws to the rim of the metal pot. At the top of this frame is attached, by screws, a piece of metal 5, in which is formed a collar for the upper end of the piston or pump-rod U. A double joint is placed within the mortice 34, of the said rod (best seen at fig. 7,), through which passes the lever V, one end of which is secured by a pin at 9, to an arm cast on and projecting out from the side post 6, of the frame. 24, is a spiral spring, coiled round the piston-rod U, and intended to force the said rod down into the cylinder *c*, of the pot S. This spring rests upon the nut 25, on the screw formed on the piston-rod U, which nut regulates the force of the spiral spring 24. On the platform D, (see fig. 4,) is the stud 35, the head of which forms the fulcrum of the lever X, that carries the antifriction-roller 36. The levers V, and X, are connected by a joint at each end of the upright rod 10, at the upper end of which rod is a screw and jam-nut.

Fig. 6, is a section, shewing an inverted plan of part of the upper surface of the machine. By withdrawing the connecting pin 37, out of the collar W, and shaft G, and taking the coupling tension-rod Q, out of the socket 2, the arms H, I, can be brought back without causing any other movement of the machine; and by this means the greatest facility is afforded for putting on, taking off, adjusting, or otherwise sorting the mould, as also for the purpose of cleaning and inspecting various parts of the machine. The mould being returned to its former position, the connecting-pin driven home, and the coupling tension-rod replaced in its socket, the machine is ready for further operations.

Fig. 8, is a plan of the pot s, for holding the metal; the bottom and sides of which are enclosed by an iron furnace T, (see fig. 5,) having a grate 45, for the fuel, a door on one side, and a smoke-pipe 11, with an ash-pan 43, below; the whole supported on brackets 12, 12, planted and fixed by bolts on the table A.

Fig. 7, is a section, shewing the inner formation of the pot s. In the upright part *a, a,* the cylinder *c,* is formed; from which the passage *d,* leads into the upright passage *f.* In the cylinder *c,* is fitted the piston *h,* bored through the centre, to receive the valve-rod *i,* and to admit the metal into the passages *d, f.* At the lower end of the piston-rod U, is attached the piston *h,* by the nut *b.* At the termination of the upright passage *f,* is fitted a self-adjusting nipple *k,* having a small aperture in its centre; the lower end of which is either conical or spherical, and has its seat formed in a counterpart *n, n.* *m,* is a screw, the point of which enters a hole on the side of the nipple *k,* to prevent it being lifted out, but, at the same time, allowing an adjusting movement when the mould is brought down upon it.

The mode of working the improved machine is as follows:—Figs. 1, and 2, represent the machine at rest, and ready for the operation of casting. The mould having been properly adjusted, and the matrix placed therein, and the circular spring 23, acting upon it, and both parts or sides of the mould being held in contact by the pressure of the coupling tension-rod Q, it rests about an eighth of an inch above the nipple *k;* and the verge of the notch of the wiper M, (best seen in fig. 4,) rests on the antifriction-roller 36, of the lever X. The metal in the pot S, being melted, flows through the aperture of the piston *h,* at the valve *i,* into the passages *d, f.* The workman, by turning the handle L, causes the arm N, on the shaft K, to revolve; and the antifriction-roller 40, of the arm N, working in the excentric slot of the segment O, brings the mould close down on the nipple *k,* of the pot S;—the aperture in the mould, and the aperture in the nipple, being then directly opposite each other. At the same time the notch of the wiper M, passes over on the roller 36, on the lever X; and the spiral spring 24, depresses the piston-rod U, and the piston *h,* upon the valve *i;*—thus shutting the communication and forcing a portion of the metal up through the small aperture in the nipple *k*, into the mould and matrix, and thereby forming the type. By continuing the rotation of the shaft K, the piston *h*, is raised to its former position by means of the lever V, which allows the metal again to flow down the aperture in the piston *h*; and the antifriction-roller 40, on the arm N, acting on the inner surface of the excentric slot of the segment O, raises the arms H, I, with the mould. During this elevation, the tilting-lever Y, on the arm H, is brought into action, the hooked end of which, working over the antifriction-roller 21, gradually depresses the other end of the lever Y,—thereby freeing the matrix 41, from the face of the type. But although the type is freed from the matrix, it still adheres to the side of the mould carried by the arm H; and it is at this particular time that the pushers 31, 31, come in contact with the type. By means of the coupling tension-rod Q, extending outwards, the opening-arm I, draws the pushers 31, 31, of the levers Z, across the face and jet of the part of the mould on the arm H, and thus discharges the type from the mould. The further turning of the handle L, brings the mould down to its former position, when it is ready for further operations. It should be remarked that, in working the improved machine, brushes are used by the workman for removing any accumulation of metal from the surface of the nipple or mould.

The patentee claims, First,—regulating the proper supply of molten metal to the mould and matrix by means of the piston or plunger, and the general arrangement of the parts in connection with the melting pot, as described and represented, but more particularly in the section fig. 7.

Secondly,—the general arrangement of the mechanism, above described and shewn in the drawings, for working the moulds and matrices of printing types and other similar raised surfaces, as well as quadrats and spaces.

Thirdly,—the moveable jaw or arm I, turning on a centre, as shewn, and capable of adjustment in the manner represented and described.

Fourthly,—the tension-rod or bar Q, with its capabilities of adjustment, as described.

Fifthly,—the mechanism for liberating the type or other form from the mould when the casting is complete, consisting of the lever Y, for tilting the matrix, and in this manner withdrawing it from the casting; and also the lever Z, for pushing out the casting, and causing it to fall out of the mould into a proper receptacle placed below it.—[*Inrolled June*, 1849.]

To William Edward Newton, *of the Office for Patents,* 66, *Chancery-lane, in the county of Middlesex, civil engineer, for improvements in engines or apparatus principally designed for pumping water,—being a communication from abroad.*—[Sealed 12th February, 1849.]

The inventor commences his specification by the following introductory remarks:—In the ordinary arrangements of a direct-action pumping-engine, the momentum of the moving parts, or the action of a spring, has heretofore been depended on for carrying the steam-valve across the steam ports or openings, in order to admit steam to the opposite end of the cylinder and change the motion. In slow motions, momentum has been found to be insufficient; as its tendency is to push or draw the valve over the ports, and stop the machine. The spring too varies in its tension, and is subject to mechanical derangement and uncertainty. To produce the motion of the steam-valve in the improved engine, the inventor makes two openings into each end of the pump or water cylinder, instead of the ordinary water-way for a double-acting pump, as shewn in Plate VII., wherein fig. 1, represents a longitudinal vertical section, taken near the middle of the apparatus. A, A, are the two openings, which join each other, and form one main opening B. Now, when the piston, in moving from right to left, arrives nearly at the end of the stroke, the resistance is suddenly removed, for the reason that the piston passes between the two openings and allows the fluid pressed before it to pass, without obstruction, behind it, in the direction of the arrow. When the resistance thus suddenly ceases, the momentum of the moving parts, and the expansion of steam within the cylinder, continues to act on the piston P; and the arm K, on the piston-rod, is carried forward and made to act against the stops or tappets L, upon the valve-rod R: the effect of this is to push the steam-valve V, with quickness and certainty entirely across the ports or openings into the position shewn at fig. 1, and detached, upon an enlarged scale, at fig. 2.

Several ways for thus relieving the resistance will occur to a mechanic; as, for example, the cutting of longitudinal grooves or flutes in the pump-cylinder, over which the piston may pass; or by connecting the two ends of the pump-chamber together by a pipe, in which a cock will open and close, at the proper time, by the motion of the engine; or a valve may be put in the piston itself, so contrived as to let the fluid pass through it.

The method first described is, however, preferable, from its simplicity, and has been found to answer well practically. Any other convenient arrangement of parts may be employed for relieving or reducing the resistance against the pump-piston, at or near the end of the stroke, so as to allow the momentum and expansion to act upon the steam-valve, in the manner above stated, as this is the result desired to be attained, and which constitutes one of the principal and distinguishing features of the invention.

The ordinary slide-valve is well known to admit steam in such a way as to drive the piston in a direction contrary to that in which the valve itself moves; therefore, when a valve of this construction is used on a direct action pumping-engine, it is necessary to employ an intermediate lever to actuate it; inasmuch as when the piston is moving from right to left, the valve-rod should be moved from left to right, in order to reverse the motion of the piston. In his improved construction of valve, instead of one cavity in the face, the inventor makes two, as shewn in the drawing at B, B, and cuts out two recesses C, C, from the valve-seat, over which recesses the valve traverses far enough to admit the steam under either end, as may be required. An enlarged view of this valve, which may be called a "B-valve," is shewn in section at fig. 2, and in plan at fig. 3. When the valve is carried from right to left (or into the position shewn in the drawing at figs. 1, and 2,) the steam will pass under it and into the cylinder, as shewn by the arrow 1, while the exhaust will go out in the direction of the arrow 2.

The improved pump-valves, which may be called "radial valves," consist of four flat plates of brass, or other material, arranged round a common centre; and their seats form the radii of a circle. The centre-piece or spider, which forms the valve-seats, is cast separate, so as to allow of the faces being planed up and properly fitted; after which it is secured into the external ring or case D, D, as shewn at fig. 1. The passages are carried up to the centre, as seen at E, E, in order to keep the lower or suction-valves covered with water, even though the valves themselves should be leaky. The water is drawn in at F, through a flange, cast on to one of the covers or caps of the valve-box, as shewn in the side view, fig. 4. The water, on entering the case D, lifts one of the suction-valves G, and passes through the openings E, and A, into the pump-cylinder; while, at the same time, the water forced out by the piston Q, passes through the opposite openings A, A, lifts one of the force-valves H, and escapes through the force-pipe I. On reversing the motion of the piston, the contrary effect takes place, as is the case in all double-acting pumps. By unscrewing the nut N, on the bolt that passes from side to side through the centre hole J, an attendant may instantly and easily get at all the valves of this pump;—thus avoiding the inconvenience and delay usually attending the performance of this important duty.

In constructing the pumping-engine, the frame or bed-plate, upon which the two cylinders are usually bolted, is dispensed with; and in its place a semicylindrical cradle is used, to each end of which the cylinders are bolted, as shewn in the side elevation, fig. 5. Allowing that the two ends of the cradle are properly faced up, as also the ends of the cylinders, it is plain that the work must come together in line, and keep so, as the strain is directly through the fastenings. In the smaller sizes of engines, the two cylinders and cradle are cast all in one piece, and the stuffing-boxes are screwed in, as shewn at S, in the drawing.

The patentee claims removing or reducing the resistance against the piston of the pump at the proper time in the stroke, in order to allow the momentum of the moving parts, and the expansion of the steam already within the cylinder, to act as explained, so as to throw the steam-valve across the ports with certainty, whether at high or low speeds; and this he claims under any of the arrangements herein contemplated, or any other substantially the same, by which this accelerated motion of the piston, at or near the end of the stroke, may be produced. He also claims arranging pump-valves upon seats that radiate from a common centre, as above set forth.—[*Inrolled August*, 1849.]

To NATHAN DEFRIES, *of Grafton-street, Fitzroy-square, civil engineer, and* GEORGE BROOKS PETTIT, *of Brook-street, New-road, in the county of Middlesex, gas-fitter, for improvements in applying gas to heat apparatus containing fluids, and in heating and ventilating buildings; also improvements in gas fittings and apparatus for controlling the passage of gas.**—[Sealed 5th March, 1849.]

THIS invention consists, firstly,—in improvements in applying gas to heat water in baths; and, secondly,—in heating fluids by heat derived from the pipes or passages which carry off the products of combustion when gas is employed in the ventilation of buildings.

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* By a disclaimer, dated September 5th, 1849, the words "also improvements in gas-fittings and apparatus for controlling the passage of gas" are erased from the title of this patent, which now reads, for "improvements in applying gas to heat apparatus containing fluids, and in heating and ventilating buildings."

It has heretofore been the practice to heat water in baths by the combustion of gas; but in such case the flame produced has been caused to act upon the whole body of water contained in the bath. Now, one part of this invention consists in causing the flame to act upon tubes or other vessels, presenting an extensive surface, in proportion to their internal capacity, which are placed below the bath, and connected at each end with the same; so that the water, on becoming heated, will ascend into the bath, and its place will be supplied by the descent of cold water from the bath.

Another part of this invention consists in constructing baths in the manner shewn at figs. 1, and 2, Plate IX.; so that the same may be heated by the combustion of gas; the object being to obtain a more extended surface than the area of the bottom of the bath would offer, and yet not materially to increase the quantity of water to be heated. Fig. 1, is a longitudinal section, and fig. 2, a transverse section of the bath. The bottom *a*, of the bath is made with a series of angular or similarly formed elevations and depressions therein; over this bottom is fixed a false bottom *b*, perforated, and constructed with a series of angular projections, in the manner shewn; and, when the false bottom is in its place, there will be a series of narrow water-spaces formed between the two bottoms, which, together with the water-spaces *c*, *c*, communicate, by suitable openings, with the water in the bath; so that as the water becomes heated by the combustion of the gas, which issues through orifices in the pipes *d*, *d*, it will ascend into the bath, and its place will be occupied by cold water.

The last part of this invention relates to the mode of ventilating buildings by the combustion of gas, and consists in rendering the heat, so produced, available for the purpose of heating fluids, by surrounding the tube, which conveys the heated products away from the gas-burners, with another tube or vessel containing the fluid to be heated,—openings being made through the tubes to permit the air to pass into the same from the apartment to be ventilated. If a large quantity of gas is consumed, the fluid may be caused, by the heat thereof, to circulate through a series of pipes, in the same manner that hot water is now caused to circulate through pipes (in order to heat buildings), and for a like purpose.

When the whole of the heat produced by the combustion of the gas is required to be transmitted to a particular locality, then the part of the tube that extends through the apartment which is not to receive any portion of the heat is to be surrounded with felt or other non-conductor of heat.

The features of novelty claimed are, Firstly,—the means, above described, for applying gas to heat water in baths. Secondly,—the means of heating fluids by the ventilating-pipes or passages used for conducting off the heated products from gas.—[*Inrolled September,* 1849.]

To WILLIAM PAYNE, *of New Bond-street, in the county of Middlesex, watch and pedometer maker, for certain improvements in clocks and watches.*—[Sealed 14th March, 1849.]

THE first part of this invention relates to that class of clocks in which the expiration of the hours, half-hours, quarters, and other determinate spaces of time is indicated by musical sounds or chimes. In clocks of this description, as commonly constructed, the musical sounds or chimes have been produced by the action of hammers upon bells; and, consequently, it has been requisite to employ rather complicated mechanism to obtain the desired effect. Now the present improvement consists in the adaptation of metallic springs for producing the musical sounds or chimes, whereby the mechanism is simplified, and more harmonious sounds may be obtained.

In Plate IX., is shewn an edge view of a clock, having this improvement applied thereto. *a,* is the framing; *b,* is a barrel, containing an ordinary clock-spring; *c,* is a füzee, connected with the barrel *b,* by the chain *d; e, e,* are wheels, by which motion is transmitted from the fuzee *c,* to the pin-barrel *f;* and this barrel acts upon the ends of the metal springs *g,* affixed to a cross bar of the framing, and thus produces the musical sounds. It is stated that the apparatus for releasing the barrel *f,* and regulating its revolution, is the same as that employed in clocks wherein the chimes are sounded on bells.

The second part of this invention consists in the adaptation of metallic springs to watches, in order to indicate the expiration of determinate intervals of time by musical sounds or chimes. The various parts used for carrying out this part of the invention are stated to be of exactly the same nature as those above described, but of smaller size.

The patentee claims, as his invention, the adaptation of metallic springs to the production of chimes or musical sounds in clocks and watches in manner above described.—[*Inrolled September*, 1849.]

To Peter Llewellin, *of Bristol, in the county of Gloucester, brass and copper manufacturer, and* John Hemmons, *of the same place, brass-founder, for improvements in the manufacture of cocks or valves for drawing off liquids.*—[Sealed 23rd November, 1848.]

These improvements consist in a peculiar construction of mechanism for opening or closing the way provided in cocks or valves for the flow of liquids or fluids by the agency of a screw or disc-valve, and also for rendering the same steam and water-tight. The valve is raised for closing the way, or lowered for opening the way, by means of a hollow screw in the rotary stem of the lever, winch, or handle; which screw acts upon the disc-spindle (answering to the ordinary plug of a cock). By the turning of this rotary hollow threaded stem (which is rendered steam and water-tight) the spindle of the disc-valve is moved up or down;—it being guided by feathers or wings sliding in the socket below. The face of the disc, when raised and brought into contact with the mouth of the aperture or way, closes the aperture or way, and stops the flow of liquid or fluid; but when the disc is lowered the way is opened, and the liquid or fluid flows through the cock freely.

In Plate VIII., fig. 1, represents a section, taken vertically in a longitudinal direction through a cock, constructed upon the improved plan, for drawing off liquids. The barrel, way, and nozzle for the passage of the fluid is represented at *a, a,* and the disc-valve at *b*. The face of the disc (packed or ground flat), when brought up into close contact with the lip or edge of the circular aperture *c, c,* as shewn at fig. 1, closes the way, and consequently prevents the passage of fluid; but when the disc *b*, is lowered, the way through the aperture *c, c,* becomes open, and the free passage of fluid upwards through the way takes place, to discharge itself at the nozzle. The disc *b*, is fixed upon a spindle *d*, having a screw or worm at its upper part, acting in a hollow screw *e, e,* in the lower part of the stem of the handle, winch, or lever *f*; and from the lower part of the spindle *d*, wings or feathers *g, g,* extend, and slide in vertical grooves in the socket or plug *h, h,* which closes the bottom of the cock. The stem *e, e,* (made hollow and having an internal screw, as before said, fitting the thread or worm upon the spindle *d,*) has a flange *i, i,* which is ground and accurately fitted to the interior of the socket *j, j,* at the upper part of the cock. This flange may also be packed with a collar of India-rubber, leather, or other fit material, to render it as perfectly air and water-tight as possible;—it must then be secured in its position by a ring-cap *k, k.* On turning the stem *e,* by means of the winch or levers *f, f,* the rotation of the hollow screw, acting upon the thread of the spindle *d,* will raise the disc *b,* into close contact with the under part of the aperture *c, c,* and thereby close the passage or way of the cock perfectly air and water-tight. On turning the winch or levers *f,* in the opposite direction, the screw *e,* will cause the disc *b,* to descend, and, consequently, to open the way for the passage of the fluid.

The same principle of construction may be variously modified, as, for instance:—Fig. 2, represents, in partial section, the internal arrangements of a cock, with the improved construction for working the disc-valve: most of the parts are similar to those described in the first figure. *a, a,* is the channel or way for the flow of the liquor; *b,* is the valve—in this instance a solid disc of metal, ground and rendered perfectly flat on the upper side; *c, c,* points out the lip or edge of the aperture through which, when the valve is open, as shewn in this figure, the liquor flows upward and discharges itself at the nozzle; and *d,* is the spindle of the valve, having its thread or screw at top, taking into the hollow screw *e,* in the rotary stem of the winch or levers *f, f.* On this stem there is a flange or ring, fixed with packing *i, i,* which is fitted tightly into a socket *j, j,* at the upper part of the cock; and these are confined in their position by a ring-cap *k, k,* tightly screwed upon the outside of the socket. The disc-valve is raised or depressed by turning the rotary stem *f,* as before described;—the feathers or wings *g, g,* at bottom of the disc-spindle *d,* sliding up and down in grooves, and thereby preventing the disc and spindle from being turned round as it ascends or descends.

Fig. 3, is a longitudinal section of a cock, constructed upon the improved plan, and designed principally for the passage of steam; and fig. 4, is an external top view of the same. e way *a, a, a,* for the passage of steam or other fluid, is wn as closed by the disc-valve *b,* which is brought up into se contact with the lip or edge *c, c,* of the aperture. The construction of the disc-valve *b*, with its spindle *d*, having the screw or worm-thread at top and feathers or wings *g*, *g*, at bottom, is shewn detached in two views at figs. 5, and 6. The flange or ring *i*, fixed upon the rotary stem of the winch at fig. 3, should be ground very accurately on all its surfaces, in order that it may fit tightly into its socket; and when covered by the winch-cap *k*, may form a perfectly steam-tight joint. The means by which the disc-valve is worked in the last-described cock is similar to that already described, and therefore will require no further explanation.

The patentees claim the construction of parts as described, particularly the accurately ground steam and water-tight shoulder of the rotary stem, with or without packing, by which a disc-valve is raised or depressed, guided, and the cock thereby made water and steam-tight.—[*Inrolled May*, 1849.]

To RICHARD PANNELL FORLONG, *of Bristol, button manufacturer, for improvements in castors for furniture.*—[Sealed 8th February, 1849.]

THIS invention consists in making the rollers of castors of glass, instead of metal or other material of which they have hitherto usually been made, and the horns and socket or plate of nickel silver, instead of brass or iron. The advantage of this substitution of materials is stated to be that, from the improved appearance of the castors, they will be suited to any articles of furniture; and that when applied to the legs or supports of musical instruments, such as piano-fortes, the tone of the instrument will be much improved and increased in power.

In Plate IX., fig. 1, represents, in edge view, a glass wheel or roller for a castor,—the wheel being mounted on a spindle between the horns, which are made of nickel silver. The wheel *a*, is made in a metal mould; and a hollow or solid brass or other metal spindle *b*, is inserted at the moment the glass is placed (in a soft or molten state) in the mould. By this means the hollow or solid spindle *b*, becomes firmly fixed in the glass; and it only remains to grind the periphery of the wheel, in order to make it perfectly round; and also to grind and polish the sides, to make them flat and run true in the horns of the castor. The sides are ground and polished in the ordinary manner; but, to make the periphery true, the patentee employs an apparatus similar to that shewn in side and end views at figs. 2, and 3. The glass wheel, seen at *a*, is mounted on the points of two spindles *d, d*; the ends of which enter the hollow spindle *b*, of the glass wheel, and are furnished with two cheeks *c, c*, covered on the inside with leather, to prevent them from slipping; the cheeks of these spindles, when properly screwed up, firmly hold the glass wheel, and carry it round with them and the spindles *d*. The periphery of the glass roller is brought into contact with a grindstone or wheel *e*, on the axle of which are two pulleys *f*, one on each side of the wheel *e*; from these pulleys a band passes to and drives a second pair of pulleys *g*, on the spindles *d*, which carry the glass wheel. On communicating rotary motion to the grindstone or wheel *e*, the pulleys *f*, and *g*, will cause the glass wheel *a*, to rotate in the opposite direction,—when the grindstone *e*, will accurately grind the periphery of the glass wheel *a*. It should be understood that the bearings of the spindles *d*, are made slightly adjustable by means of screws; so that, as the periphery of the glass wheel is ground away, it may be pushed forward and kept in contact with the wheel *e*; and, in order to prevent the driving bands or straps of the pulleys *f*, and *g*, from becoming loosened by this adjustment of the bearing, these pulleys are made slightly conical, to compensate for the adjustment.

The patentee claims making the wheels or rollers of castors of glass in place of metal, as has heretofore been generally the case.—[*Inrolled August*, 1849.]

To JAMES WILLIAMSON BROOKE, *of Camden Town, in the county of Middlesex, gent., for improvements in lamps.*— [Sealed 14th March, 1849.]

THIS invention relates to improvements in lamps for obtaining light by the combustion of vapour, which is produced by the volatilization of spirit contained in the reservoir of such lamps.

The first part of the invention consists in improvements in that kind of lamp in which the spirit is caused to ascend towards the burner by capillary attraction, and not by pressure. In Plate VII., fig. 1, is a vertical section of an improved spirit lamp; fig. 2, is a horizontal section thereof, taken on the line A, B, of fig. 1; and fig. 3, is a horizontal section taken on the line C, D, of that figure. *a*, is a glass vessel or reservoir, containing the spirit, which is to be screwed on the top of a suitable pedestal or stand; *b*, is the wick tube; and *c*, is the burner tube. The wick tube *b*, is fixed in a piece *d*, of wood or other material which is a non-conductor of heat; the wick *e*, is inserted into the tube by means of the instrument represented in edge view at fig. 4, and in side view at fig. 5; and the wick is securely retained in the tube by the insertion of a wedge *f*, which also determines the size of the opening for the passage of the spirit. In the top of the wick tube are two small holes for the passage of vapour, which holes can be closed, when desired, by turning the slide *g*, by means of its handle or wire g^1: this wire is affixed at its lower part to an annular plate *h*, which is capable of turning around the tube *b*, beneath the lower edge of the tube *c*. The top of the tube *c*, carries the burner c^1, which is a small metal chamber, with a series of holes formed around the lower part of the same; the lower part of the tube *c*, surrounds the upper part of the tube *b*, so as to communicate to the latter the heat derived from the burner, for the purpose of volatilizing the spirit; and at c^2, a part of the burner tube is removed for the admission of air. In this lamp, the spirit is raised from the vessel *a*, by capillary attraction, to the top of the tube *b*; there it becomes volatilized by the heat derived from the tube *c*; the vapour, so produced, passes through the two small holes in the top of the tube *b*, and, mixing with the air which enters at c^2, ascends the tube *c*; and, on reaching the upper part of the tube *c*, it impinges against the top of the chamber c^1, and, being thereby deflected, rushes through the openings in the lower part of the chamber, and is consumed.

Fig. 6, is a vertical section of a burner, of a similar construction to that shewn at fig. 1. *b*, is the wick tube, to the top of which the spirit is elevated by capillary attraction; and it is there converted into vapour, which passes through openings in the top of the tubes *b*, and b^1, and ascends through the short tube *c*, to the burner c^1.

Figs. 7, exhibit a plan view and vertical section of a burner, designed to produce a flat flame, which is effected by permitting the vapour to escape through a slit or opening formed as shewn at *i*, instead of the series of small holes represented at figs. 1, and 6.

The second part of the invention relates to that class of lamps in which the spirit is supplied to the burner by pressure. Fig. 8, is a vertical section of an improved burner. The spirit passes from the reservoir through the pipe *j*, to the vessel *k*; this vessel being in a heated state, the spirit becomes volatilized, and the vapour ascends through the hollow arm *l*; it escapes from an orifice at the under side of the end of the hollow arm, impinges upon the top of the vessel *k*, and, passing through the openings in the raised portion or rim k^1, is consumed. Figs. 9, represent a plan view and side elevation of another improved burner. In this burner, the spirit is converted into vapour by the heat of the vessel *m*; and the vapour, rushing from a single opening at *n*, against the surface *o*, is caused to spread and produce a flat flame.

The patentee states that he claims, Firstly,—the mode of constructing lamps as shewn at figs. 1, 2, 3, 4, 5, and 6; also the mode of obtaining a flat flame, represented at fig. 7. Secondly,—the construction of burners described with respect to figs. 8, and 9.—[*Inrolled September*, 1849.]

To ROBERT NELSON COLLINS, *of Oxford-court, Cannon-street, in the City of London, wholesale druggist, for certain improved compounds to be used for the prevention of injury to health under certain circumstances.*—[Sealed 2nd December, 1848.]

THIS invention consists in combining together certain substances, hereinafter mentioned, so as to produce certain compounds, which have the property of evolving or liberating chlorine when these are either moistened or mixed with water; and which compounds are therefore suitable to be used under circumstances where health would be liable to become injured by the presence of noxious gases or exhalations arising from animal or vegetable matters undergoing decomposition, or from such manufactories as evolve noxious vapours which may be rendered innoxious by the action of chlorine.

In effecting the object of his invention, the patentee prefers to use chloride of lime as the substance from which chlorine may be liberated when forming part of the improved compounds; and the matters which he combines with such substance containing chlorine (in order to produce the improved compounds) are such saline compounds as contain an acid combined with a base,—the affinity of which base for such acid is less powerful than the affinity of lime for such acid,—and which base does not prevent an evolution or liberation of chlorine from such compounds. Sulphate of alumina is employed, by preference, as the saline compound, having a base of which the affinity for the acid with which it is combined is less powerful than the affinity of lime for such acid, and as being the most suitable material to combine with chloride of lime, so as to produce one of the improved compounds. This saline compound is employed in the state of an anhydrous and, when mixed with chloride of lime containing 34 per cent. of chlorine (which proportion of chlorine is that usually contained in the article known in commerce as chloride of lime), one part, by weight, of such anhydrous sulphate of alumina is added to two parts, by weight, of chloride of lime: these substances are well mixed, and the compound thus produced is stored in closed vessels. The compound may be used for the prevention of injury to health, either by mixing it with such animal or vegetable matters as may be undergoing decomposition, as in the case of cesspools, manure heaps, and other collections of putrescent matters; or it may be used by being placed in open vessels, near to such decomposing matters. In most instances sufficient moisture will be obtained from the decomposing matters themselves, or from the surrounding atmosphere, to cause the chlorine to be liberated from the compound; but, if required, water may be added thereto. A gradual evolution of chlorine will then take place, and effectually prevent any contagious or noxious effluvia from being given off by the putrid matters.

Instead of using chloride of lime, as the substance containing chlorine to be employed in the production of the improved compounds, the patentee states that he can also employ chloride of magnesia; and, as a substitute for sulphate of alumina (as the saline compound to be employed in the production of the improved compounds), he can use other salts of alumina, and also salts formed of peroxide of iron, oxide of zinc, oxide of lead, or oxide of manganese, combined with sulphuric, nitric, or muriatic acids. When employing these saline compounds, he adds to the chloride of lime, or to the chloride of magnesia, as the case may be, such a proportionate quantity of the saline compound as contains a quantity of acid equivalent to the quantity of acid contained in the proportionate quantity of sulphate of alumina before indicated as being suitable to be combined with a defined quantity of chloride of lime.

The patentee, in concluding his specification, states that he does not confine himself to the use of the materials which are expressly mentioned as being preferable, nor to the particular proportions above given; for these may be varied, to some extent, without departing from the nature of his invention, which consists in combining together certain substances, hereinbefore defined, so as to produce compounds which have the property of evolving or liberating chlorine when moistened or mixed with water, and are consequently suitable to be used for the prevention of injury to health under certain circumstances.—[*Inrolled June,* 1849.]

To Pierre Isidor David, *of Paris, in the Republic of France, for improvements in bleaching cotton.*—[Sealed 28th February, 1849.]

This invention consists in a mode of bleaching cotton by means of chlorine gas.

The apparatus employed for carrying out the invention is shewn, in elevation, in Plate IX. *a*, is a retort, set in a sand-bath over a furnace; *b*, is a leaden pipe, through which muriatic acid is introduced into the retort; *c*, is another leaden pipe, for conducting the chlorine gas from the retort into the vessel d^1; and *e*, *e*, *e*, are three leaden pipes, by means of which the vessels d^1, d^2, d^3, d^4, are connected together. The vessels d^1, d^2, d^3, d^4, are made of glass or other material capable of resisting the action of acids; and they serve for purifying, washing, and drying the gas: the vessel d^1, is empty; the vessels d^2, and d^3, are half filled with water; and the vessel d^4, is half filled with sulphuric acid of 66° Beaumé, To each of the vessels d^2, d^3, d^4, is applied a vertical glass tube *f*, which descends nearly to the bottom of the vessel, and is employed for the purpose of indicating, by the ascent of the liquid within it, the pressure of the chlorine gas as it passes through the vessels. The vessel d^4, is connected by a pipe *g*, with a box or chamber *h*, made of wood or other suitable material, and intended to contain the cotton to be bleached, which is placed therein upon a perforated false bottom of lead;—such bottom being fixed above the opening whereat the pipe *g*, enters the chamber, so that the gas may enter freely beneath the false bottom, and ascend through the perforations in the same. The chamber *h*, is furnished with windows at the side and top, through which the operator can watch the progress of the bleaching process; and to the top is fixed a pipe *i*, for the discharge of the chlorine gas, provided with a cock, and having an orifice at i^1, which is ordinarily kept closed, but is sometimes opened for the purpose hereafter mentioned. *j*, is a blowing apparatus, which, when in action, forces air through the pipe *k*, into a vessel *l*, half filled with lime (to absorb any moisture contained in the air); and from thence the air passes through the pipe *m*, into the pipe *g*, and so into the chamber *h*. The blowing apparatus is also connected by the pipe *n*, with a vessel *o*, in which vapour may be generated, as hereafter mentioned; and the mixed air and vapour pass therefrom through the pipe *p*, into the pipe *k*.

The mode of bleaching cotton by means of this apparatus is as follows:—The chamber *h*, is first filled with cotton, either in the raw state or as yarn or thread in a woven state; and then it is closed air-tight. Into the retort *a*, (which should first be rinsed) is put a quantity of peroxide of manganese, in lumps, by weight about 4 per cent. of the weight of the cotton to be bleached, "if the peroxide gives 80 per cent. of pure matter, if not, a quantity proportional to its degree of purity, so as to obtain its equivalent." The cocks 1, and 2, are then opened; and upon the pipe *b*, is placed a glass or leaden funnel, through which is introduced into the retort as much muriatic acid, of 21° to 22° Beaumé, as will be equal to three times the weight of the peroxide of manganese employed, "diminishing in proportion as the manganese gives less than 80 per cent. of pure matter, and conformably always to the ordinary method of manufacturing chlorine." The cock 3, is now opened, and the cocks 2, and 1, are closed; and then the bleaching operation is commenced by the chlorine gas passing from the retort through the vessels d^1, d^2, d^3, d^4, and pipe *g*, into the chamber *h*. After chlorine gas has been evolved for a quarter of an hour in a cold state, heat is gradually applied to the retort, until it is at last brought to a temperature of 60° or 70° Centigrade,—the heat being so regulated as to terminate the evolution of gas in two hours, if the quantity of ingredients in the retort is intended to act upon one chamber only, and to terminate the discharge in four hours, if the quantity of ingredients is intended to operate on several chambers successively. The water in the tubes *f*, ought to attain the proper elevation from the commencement of the evolution of the gas; and this elevation should be maintained during the operation of bleaching, except that there will be a slight fall towards the end of the process; but if the pressure should become too great, it is reduced by removing the plug from the opening i^1, in the pipe *i*, and thus permitting a quantity of air to escape: if the excess of pressure arises from the rapid evolution of the gas, then, instead of removing the plug from the opening i^1, a portion of the gas may be discharged by opening the cock 2.

The process of bleaching can be watched through the window in the side of the chamber *h*; and when it is perceived, through the window in the top, that the gas has penetrated to the top of the chamber, the bleaching operation is finished. The cock 3, is now closed, and the cock 4, on the discharge-pipe *i*, opened; and then the cocks 5, and 6, are opened (the cocks 7, and 8, being closed), and, during the space of half an hour, air is forced by the blowing machine *j*, through the pipe *k, m,* and *g,* into the chamber *h,* to drive out the chlorine gas;—the blowing machine being worked gently at first, but afterwards more quickly. After this, the cock 5, is closed, and the cocks 7, and 8, being opened, the air is caused to pass through the vessel *o,* and carry off therefrom into the chamber *h,* volatile alkali, or the vapour of sulphuric ether, or any other matter suitable for destroying the effect of any remaining chlorine and hydrochloric acid in the cotton. The operation is finished by again forcing pure air only through the chamber *h;* or, instead thereof, the cotton may be submitted to the action of the machine known as the "hydro-extractor."—[*Inrolled August,* 1849.]

To JOHN MITCHELL, *chemist,* HENRY ALDERSON, *civil engineer, and* THOMAS WARRINER, *farmer, of Lyons' Wharf, Upper Fore-street, Lambeth, in the county of Surrey, for improvements in smelting copper.*—[Sealed 28th December, 1848.]

THIS invention consists of improvements in obtaining metallic copper from certain copper ores and other substances containing copper. The substances which are intended to be treated by the methods to be described are, 1st,—the sulphurets of copper; 2nd,—the suphurets of copper mixed with any other metallic sulphuret or sulphurets; 3rd,—a sulphuret of copper containing a sulphate or other salt of copper; 4th,—sulphuret of copper mixed with any other metallic sulphuret or sulphurets containing a sulphate or other salt of copper; 5th,—carbonates or oxides of copper; 6th,—a mixture of carbonate and oxide of copper containing a sulphuret of copper or a sulphuret of other metal; 7th,—a carbonate or oxide of copper or a mixture of a carbonate and oxide of copper with a sulphuret of copper mixed with other metallic sulphurets; 8th,—a mixture of any of the above carbonates or oxides or carbonates and oxides with a metallic sulphuret or sulphurets and a sulphate or other salt of copper; 9th,—carbonate or oxide of copper or a carbonate and oxide of copper mixed with a sulphate or other salt of copper.

In the ordinary method of copper smelting, the sulphuret ores are subjected to a numerous series of alternate roastings and fusions, the ultimate object of which is to convert all the sulphur they may contain into sulphurous acid, and the iron and the copper into oxides; the oxide of iron passes off in the siliceous slag, whilst the copper is concentrated in the regulus, which at last is brought into such a state, by the above operations, that it contains but little sulphur and iron; both of which substances are removed by the refining process, which, in this stage, it has to undergo; and the copper, thus produced, is either cast into ingots, or is submitted to another operation, by which it acquires the desired degree of malleability.

It is therefore evident that the object of all the above operations is to remove the sulphur and iron: this is done progressively and at the same time in the process just described. This object the patentees propose to effect by two distinct operations. By the first the sulphur will be entirely removed by treating a rich ore or a regulus (obtained without the addition of iron or alkali), in a finely divided state, in the manner to be hereafter described; and by the second the iron will be separated, and the copper obtained in a comparatively pure state, by treating the mixed oxides, resulting from the first operation, with siliceous and carbonaceous matters, without the use of iron, or the application of electric currents.

Thus, by the new process, the smelting or production of copper from copper ores is effected by fewer operations, and in a much shorter time, than in the ordinary process. In many cases but one roasting and one fusion will be necessary, and in others, at most, two roastings and two fusions.

The chief difficulty in getting rid of the last traces of sulphur depends upon the circumstance that, during the ordinary roasting of sulphur ores of copper, the whole of the sulphur is not expelled in the gaseous state as sulphurous acid, but a portion is converted into sulphuric acid, which unites with a corresponding equivalent proportion of oxides of copper and iron to form sulphates of copper and iron. This however is not all, for if lime, baryta, strontia, or magnesia be present, either in the caustic or carbonated state, then a still greater quantity of sulphuric acid is retained by those bases to form sulphate of lime, baryta, strontia, or magnesia. Now, the patentees have found that whilst sulphates, either of copper, iron, lime, baryta, strontia (these three latter sulphates may be disregarded in practice, as the results they produce are not sufficiently marked to be injurious), and magnesia are present, that on reducing the mixture of oxides of copper and iron, and the sulphates of iron, copper, &c., the latter are decomposed, giving rise to the production of sulphurets of iron and copper in addition to the metallic copper and iron produced, so that a very considerable portion has to undergo a further roasting. In the new process, about to be described, this difficulty is overcome. Again, when a mixture of oxides of copper and iron, free from sulphur, are to be reduced, it will be found that copper is indeed separated, but containing a very large quantity of iron;—the copper so produced would therefore have to be refined, in order to fit it for the market. This is avoided by forming silicates of copper and iron, and then reducing by carbonaceous matter: the silicate of copper is completely reduced and separated, whilst the silicate of iron is left intact.

Owing to the influence of the presence of lime, baryta, strontia, and magnesia (more especially the latter earth) on the roasting process, it is found desirable to divide all copper ores, and other substances enumerated as susceptible of treatment by the present process, into two grand classes, thus:—

1st Class. Those ores or substances containing neither lime, baryta, strontia, nor magnesia, in the caustic or carbonated state, or in the state of sulphate.

2nd Class. Those ores or substances which contain lime, baryta, strontia, or magnesia (more especially the latter), in the caustic or carbonated state, or in the state of sulphate.

These classes are each subdivided into two orders, viz.:—

Order 1. Those ores or substances which contain more than 25 per cent. of copper.

Order 2. Those ores or substances which contain less than 25 per cent. of copper.

All ores and other substances enumerated as susceptible of treatment by the present process, and which belong to class 1, may be treated according to process No. 1, whether they belong either to Order 1, or 2.

Process No. 1.—*Treatment of copper ores of the* 1*st Class.*— The finely-pulverized (fine dressed) ore is placed in a reverberatory furnace, known as a "calciner" (a furnace constructed according to Sheffield's patent, having air passing through openings in the bridge over the roasting ore in the furnace, is preferred), and exposed to a gradually increasing temperature, until it arrives at a full red heat. During the whole of the time it is in the furnace it is stirred from side to side, and from end to end, in order to expose the greatest possible surface to the oxidating action of the heated atmospheric air passing over the roasting matter. This is to be continued until the ore ceases to smell of sulphurous acid. The heat is now to be increased as much as possible, taking care, however, that the heated ore does not, in the slightest degree, agglutinate (this point must be particularly attended to),—the stirring all this time being constant. The object of the increased heat is the decomposition of the sulphate of copper, formed during the earlier stage of the roasting. At the higher temperature this salt is decomposed and its acid expelled. This may be facilitated by the addition of small quantities of any carbonaceous matter, as is already known. After it has been in this state about half an hour, a sample is to be taken out, mixed with a small quantity of water, and well stirred, allowed to settle, and the clear supernatant liquid poured off. If, on the addition of solution of ammonia, the liquid assumes a blue tint, or, on the addition of ferrocyanide of potassium, a reddish tint, the heat is to be continued for another half hour; after which time it is again to be tested in the same manner, and so on, until no copper can be detected in the aqueous solution. The ore may now be drawn from the furnace, and is ready for the reducing operation to be hereafter described.

Process No. 2.—For ores and substances of the 2nd Class, enumerated as susceptible of treatment by this process.—The finely-pulverized (fine dressed) ore is to be roasted precisely as described for ores of class No. 1; but, before being ready for the reducing process, it has to undergo the following operation, which has for its end the separation of the sulphate of magnesia which has withstood decomposition (as before stated, the danger attached to the presence of the sulphate of lime, baryta, and strontia, is so small, that in practice it may safely be disregarded):—The roasted ore, while still hot, is conveyed into a tank (provided with a false bottom) containing a considerable quantity of water, and well agitated; after having remained in the water about three or four hours, with occasional agitation, the water, containing sulphate of magnesia in solution, is run off from the bottom of the tank; and the ore, thus washed, is allowed to drain as much as possible. It is then removed and dried, and is fit for the reducing process.

When the ore contains less than 25 per cent. of copper (Order 2nd) it is thrown into a "fusion" or "metal" furnace, with a certain quantity of lime or old slag, as is usual in such operations; and the regulus so produced is run into sand moulds or into water. It is preferred to give the ore a partial roasting before forming a regulus, as in the following process:—The finely-pulverized (fine dressed) ore is placed in the furnace (calciner) already described, and exposed to a dull red heat until very little or no more sulphurous acid can be smelt. The ore is then removed to another reverberatory furnace, known as a fusion or metal furnace, and mixed with an appropriate quantity of lime or lime and old slag, to form a fluid mixture when exposed to a sufficient temperature. When the whole is well fused, the furnace is tapped, and the regulus run into either sand moulds or water. The regulus produced by either of the preceding methods is reduced to a state of fine division, and in that state it is roasted, exactly as described for ores and substances under Process 1, Class 1; after which, it is ready for reducing.

Reducing Process.—The roasted ore or regulus is mixed with such a proportion of sand as will correspond to the amount of oxide of copper and oxide of iron in the substance. Thus, if the mixed oxides consist of about 88 per cent. of oxide of copper, and the remainder be oxide of iron, from 35 to 40 per cent. of sand is required, with such a quantity of lime or old slag as will cause the whole to flow freely. On adding the sand and lime, or the sand and slag, coal or other carbonaceous matter is to be added, in the proportion of about one-tenth of the weight of the sand and lime, or sand and slag. When the whole is well fused, a further portion of coal or other carbonaceous matter is to be added to the fused mass and well stirred together; the heat is then to be increased for a short time, and the whole well stirred again. A portion of the slag is now to be taken out, and tested for copper by any ordinary method; if but traces be present, the operation is finished, and the furnace may be tapped; but if copper be present in quantity, more coal or carbonaceous matter must be added, and the mass must be again stirred, and so on until the slag is nearly free from copper, as above.

The patentees claim the obtaining of metallic copper from the ores of that metal by the processes hereinbefore described, viz.:—By effectually separating the sulphur from the metals by roasting the ore, in the manner described under Process No. 1; and by roasting and washing, as described under Process No. 2; and (when the ore is poor) by forming a regulus, without the use of iron and alkali, and subsequently roasting, as is also described under Process No. 2; and by separating the iron from the mixed oxides resulting from the roasting processes, by the employment of siliceous and carbonaceous matters, as above described, for the purpose of obtaining the copper contained in such oxides in a pure state.—[*Inrolled June*, 1849.]

To Andrew Shanks, *of Robert-street, Adelphi, engineer, for an improved mode of giving form to certain metals when in a fluid or molten state.*—[Sealed 14th March, 1849.]

This invention consists in the employment of centrifugal force in the forming of metal castings, whereby tubes and cylinders, and also circular-shaped hollow vessels, may be cast without the use of cores.

The casting of tubes and cylinders is effected by pouring the liquid metal into hollow cylindrical moulds (the internal diameter of which corresponds with the external diameter of the tube or cylinder to be cast), placed in a horizontal position, and caused to rotate rapidly; when the centrifugal force produced will cause the molten metal to spread itself in a uniform manner over the internal surface of the mould;—the thickness of the tube or cylinder depending upon the quantity of metal poured into the mould.

The machinery employed in casting tubes and cylinders is represented at figs. 1, and 2, in Plate IX. Fig. 1, is a side elevation of the machine; fig. 2, is a plan view thereof; and fig. 3, is a longitudinal section of the mould, shewing the pipe *z*, cast within it. *a*, is the metal mould, formed with two collars a^1, a^2, which rest upon the wheels *b, c, d, e*; and the collar a^2, has a rib or bead upon it, that enters into a corresponding groove in the wheels *c, e*, in order to prevent any movement of the mould in the direction of its length. On the shaft *f*, of the wheels *b, c*, is a rigger or pulley *g*, around which passes an endless band from a steam-engine or other first mover, and causes the shaft *f*, to revolve; and this motion is communicated to the mould by the wheels *b, c*. The bearings *h, h*, of the shafts *f, i*, can be caused to approach to or recede from each other by turning the screws *j, j*, for the purpose of adjusting the level of the mould, and for regulating the distance between the wheels *b, c*, and *d, e*, to suit moulds of different diameters. One end of the mould is formed with an internal flange *k*, to retain the fluid metal within it during its rotation; and, to the other end, an annular plate or ring *l*, is bolted, for a like purpose. The fluid metal is introduced into the mould, while the latter is rotating, by means of the spout *m*; and, when the metal has become sufficiently set, the rotation of the mould is stopped, it is lifted off the wheels *b, c, d, e*, the plate *l*, is taken off, and the pipe or cylinder is removed from the mould.

The apparatus employed for casting circular-shaped hollow vessels is represented, in sectional elevation, at fig. 4. It consists of a framing *n*, in which two shafts *o*, *p*, are mounted; to the shaft *o*, motion is given by a band passing around the pulley *q*; and this motion is transmitted by the bevil-wheel *r*, and pinion *s*, to the upright shaft *p*, which carries the mould *t*. On the upper edge of the mould an annular plate *u*, is bolted, to retain the fluid metal during the revolution of the mould, and to admit of the casting or vessel *v*, being removed when the metal has become sufficiently set. At the bottom of the mould is formed a socket, to fit upon the top of the shaft *p*; so that, when placed thereon, it will accompany the shaft in its revolution; and the mould may be readily removed from the shaft and replaced thereon. *w*, *w*, are the handles by which the mould is lifted.

The patentee claims, as his invention, the giving of form or shape to hollow metal castings by means of centrifugal and other force, applied to the metal while in a fluid state and continued till the metal sets; such centrifugal force being derived from a rôtary motion of the mould wherein such castings are made; and whereby he is enabled to supersede the necessity of what are usually called cores.—[*Inrolled September*, 1849.]

To George Fergusson Wilson, *of Belmont, Vauxhall, Gent., for improvements in separating the more liquid parts from the more solid parts of fatty and oily matters, and in separating fatty and oily matters from foreign matters.*—[Sealed 28th February, 1849.]

This invention consists in effecting, by centrifugal motion, the separation of the more liquid parts from the more solid parts of fatty and oily matters, and likewise the separation of fatty and oily matters from foreign substances, which may be mixed therewith.

It is well known that water may be and is commonly extracted from linen and other fabrics by placing such fabrics in a machine to which a quick revolving motion is given, and in which the fabrics are pressed, by centrifugal force, against gratings or perforated plates, forming the periphery of the machine. There are various machines constructed on this principle which might be used for effecting the objects of this invention; but the patentee prefers to employ those made by Messrs. Seyrig and Co., and termed "hydro-extractors." In carrying out the invention, the patentee employs a close woven texture, such as stout cotton twill, in addition to the wire grating; and, in order to avoid the necessity of digging out the concrete or solid parts of the fatty or oily matters after the more liquid portions have been extracted, and to prevent the more solid parts from coating or clogging up the interstices, through which the more liquid parts are expressed, he places the fatty or oily matter in a bag (made of the above or other suitable fabric), eight inches in diameter, and of such length that, when laid in the machine, against the grating, the two ends will meet. The machine being now caused to rotate, the liquid part will be separated from the more solid part of the fatty or oily matter; but the speed of the machine must be kept below that at which stearine or stearic acid would be expressed; and this may be known by the clear or turbid appearance of the expressed liquid.

The patentee states that this invention may be advantageously employed for separating the liquid parts of fatty or oily matters from those parts which have become solid from the action of cold; and, in this case, he keeps the rooms, in which the machine is placed, at a temperature about two degrees Fahrenheit above that of the matters under treatment. It may also be used for separating foreign substances, such as sand, from fatty and oily matters; and then the temperature of the room must be such as to keep the matters in a melted state. It may likewise be employed for separating fatty and oily matters from the crushed matrix, such as *copperah* (the dried kernel of the cocoa-nut), and similar substances; and, in this case, the temperature of the room must be kept at ten degrees Fahrenheit above the melting point of such matters.

The patentee says he does not claim the apparatus, above mentioned, for obtaining centrifugal motion; but what he claims is, the mode of separating the more liquid parts from the more solid parts of fatty and oily matters, and separating fatty and oily matters from foreign matters.—[*Inrolled August*, 1849.]

To Benjamin Biram, *of Wentworth, in the county of York, Gent., for improvements in miners' lamps.*—[Sealed 28th February, 1849.]

The improved miners' lamp, which forms the subject of this invention, is represented in Plate IX.; fig. 1, being a front elevation thereof; fig. 2, a plan view; fig. 3, a vertical section; fig. 4, a horizontal section, taken on the line 1, 2, of fig. 1; and fig. 5, shewing the oil-vessel detached. *a*, is the case, of the common semicircular shape, furnished with a handle *b*, whereby it may be suspended from the swivel-hook *c*, (fig. 3,) attached to a steel spike *d*, which is to be driven into the coal or into a wooden prop. *e*, is the oil-vessel, which is securely connected to the bottom of the case *a*, by over-lapping pieces a^1, and e^1,—the pieces a^1, being affixed to the bottom of the case *a*, and the pieces e^1, to the bottom of the oil-vessel. *f*, is a ring, by which the oil-vessel is drawn out when it is necessary to refill it; and *g*, is the burner. *h*, is a metallic reflector, mounted behind the burner on two pins *i*, *i*, which project from the top of the oil-vessel and enter two short tubes, soldered to the back of the reflector. *j*, is the chimney, which may be made either wholly of metal or principally of wire gauze: if made of metal, the chimney is furnished with a cap *k*, closed at top, but having a series of perforations at the side, which are protected within by a cylindrical screen of wire gauze *l*; and the cap is attached to the chimney by a screw *m*, by unscrewing which the cap can be readily removed. *n*, is the door of the lamp, consisting of a metal frame, divided into two compartments;—the upper (which is in front of the light) containing a sheet of talc *o*, and the lower being provided with a piece of wire gauze *p*, through which, alone, the air necessary to support combustion is supplied. The door is a little narrower at the bottom than at the top, in order that it may be more easily dropped into and raised from its place; but when it is in its place it should fit accurately throughout, and its top flange n^1, should come close down over the grooves in which the door slides. The door is secured in its place by a pin *w*, projecting from the ring *x*, over the flange n^1; the ring *x*, turns in a seat or channel formed for that purpose on the outside of and close to the bottom of the chimney; to the back of the ring is affixed an eye *q*, in the same diametrical line with the pin *w*; and there is a similar eye *r*, affixed to the top of the case *a*, against which the other eye abuts when the pin *w*, is in a central position over the door *n*; so that when the hasp of a padlock *s*, is passed through both eyes, the interior of the lamp is secured from being meddled with by the miners. *t*, is a ball-and-socket joint, fixed in the back of the case *a*; and *u*, is a pricker, for trimming the wick: it passes through the joint *t*, and through an opening in the reflector, and moves freely by means of the ball-and-socket joint, within certain limits, determined by a twist which is given to it near the inner end, to prevent it being entirely drawn out of the case. . . .

If this lamp be taken into an inflammable atmosphere, the noxious gas, which passes through the wire gauze *p*, ignites, and burns within the lamp, with a blue flame; and, by absorbing the supply of oxygen, it extinguishes the flame of the burner *g*, (unless the lamp be removed into fresh air) but with no other inconvenience to the miner than the loss of his light. To enable a miner to work in a part of a mine charged with carburetted hydrogen (such being occasionally necessary), a circular opening, covered with wire gauze, may be substituted for the rectangular opening covered by the piece of wire gauze *p*, (as indicated by the dotted circle *v*, fig. 1,) and a tube of vulcanized India-rubber or other flexible material, carried from the circular opening into the pure air, may be provided, to furnish the flame with the requisite supply of oxygen to maintain combustion. Instead of the door being made with two compartments, one containing talc and the other wire gauze, it may be made with a single opening, by substituting wire gauze for the talc.

The patentee claims, as his improvements in miners' lamps, Firstly,—the combination of a metallic reflector with the burner. Secondly,—the combination with the burner and reflector aforesaid of a front cover or door, composed partly of talc and partly of wire gauze, or wholly of wire gauze, as above described. Thirdly,—the combination of the parts *n, w, x, q, r,* and *s,* in manner above described, whereby all access to the interior of the lamp is prevented, except by means of a key. Fourthly,—the employment of a pricker to raise, depress, or trim the wick, revolving in a universal joint, and moving to and fro in the ball of the joint. Fifthly,—the combination of a wire gauze aperture for the admission of air to the lamp, with a flexible tube leading from it to the open air.—[*Inrolled August,* 1849.]

To ROBERT ROSS ROWAN MOORE, *of the Temple, barrister-at-law, for improvements in the manufacture of letters and figures to be applied to shop fronts and other surfaces.*—[Sealed 14th March, 1849.]

THE first part of this invention consists in the employment of gutta-percha for manufacturing letters and figures, to be applied to shop fronts and other surfaces, and which will not be affected by moisture.

The gutta-percha is purified in the manner commonly practised; it is subjected, while in a plastic state, to pressure in moulds, in which it is allowed to remain until it has become set and cold; and then the letters or figures are taken out of the moulds, and their edges trimmed or pared. If preferred, the gutta-percha may be mixed with any other suitable materials, which will not lessen the capability of the mass to resist moisture, but will enable it to withstand better the action of heat. The letters or figures made in this manner may be afterwards painted and varnished; or the desired color may be mixed with the gutta-percha in the first instance; and the letters or figures will then only require to be varnished.

The second part of the invention relates to the manufacture of ornamental letters and figures, to be applied to shop fronts and other surfaces; and it consists in using glass for this purpose, either of different colors and shapes, or else uncolored, with substances of different colors placed behind, so as to produce varied ornamental effects.

In Plate IX., fig. 1, is a front view of a letter, made according to this part of the invention; and fig. 2, is a transverse section thereof, taken on the line A, B, of fig. 1. *a, a,* are pieces of glass which are colored red, in the drawing attached to the specification; *b, b,* are pieces of uncolored glass; and *c,* is an open frame of metal or other suitable material, painted or gilt, and suitably formed for covering the joints of the glass and the materials behind the glass. The body *d,* of the letter is to be made of gutta-percha; as recesses for the reception of the glass can then be more readily made therein than if the body were made of wood or other material; but yet, if preferred, the bodies may be made of wood or other material. The drawing represents a shaded projecting letter; but the letters may be made without shading, or upon a flat surface, so as to represent projection;—the drawing being simply intended as an example of the mode of carrying out this part of the invention; for the form of the letter, and the shape of the different pieces of glass, and of the other materials at the back of the glass, may be varied. In glazing the letters or figures, a waterproof cement should be used for filling the joints and other parts, to prevent any moisture penetrating to the back of the glass: for this purpose gutta-percha cement is preferred. The frame *c,* for covering the joints, is affixed by pins; or if of gutta-percha, or other material which will permit it, gutta-percha cement is employed.

The patentee claims, Firstly,—the manufacture of letters and figures, applicable to shop fronts and other surfaces, by the employment of gutta-percha in such manufacture. Secondly,—the mode of manufacturing ornamental letters and figures, to be applied to shop fronts and other surfaces, as above described.—[*Inrolled September*, 1849.]

To WILLIAM COMBAULD JACOB, *of* 5, *Bread-street, in the City of London, warehouseman, for improvements in the manufacture of parasols and umbrellas.*—[Sealed 20th June, 1849.]

THIS invention consists in the application to the manufacture of umbrellas and parasols of a material or fabric not heretofore used for that purpose.

The material or fabric is produced by "shooting" a warp of cotton with a weft of silk or linen, or of silk and linen combined, or of silk and cotton, or by shooting a warp of linen with a weft of silk or linen, or of silk and linen, or of silk and cotton combined. If desired, the fabric may be figured, striped, or otherwise ornamented, by conducting the operation of weaving in a suitable manner to effect this object; or by introducing silk threads in the warp at those parts where the figure, stripe, or border is to be produced. As this kind of fabric has been heretofore used for other purposes, the patentee does not consider it necessary to give a description of the mode of manufacturing the same; but he states that he prefers to employ eighty warp-threads to the inch, and one hundred and twenty weft-threads to the inch. In order that the material may be cut up without waste, it is to be manufactured in widths of twenty-two, twenty-four, and twenty-six inches for umbrellas, and of fourteen, sixteen, eighteen, and thirty-eight inches for parasols. The fabric is cut up and employed for covering the frames of umbrellas and parasols in the same way as when silk is the covering material.

The patentee claims, as his invention, improvements in the manufacture of parasols and umbrellas by the use of a material, not heretofore used for that purpose, in covering of sticks or frames of umbrellas and parasols, in the manner at present adopted;—such material to be made by combining cotton or linen, to be used as warp, with silk or linen, or a combination of silk and linen, or silk and cotton, to be used as weft, with the introduction (necessary to make such covering figured, striped, or ornamented) into the warp of a sufficient number of silk threads to form such figure, stripe, or ornament.—[*Inrolled August*, 1849.]

To Francis Hay Thomson, *of Hope-street, in the City of Glasgow, North Britain, Doctor of Medicine, for an improvement or improvements in smelting copper or other ores.**—[Sealed 14th March, 1849.]

This invention consists in the application of whinstone, or iron slag (which is of a similar nature to whinstone), or trap, basalt, syenite, or other stones of the same character as whinstone, being fusible silicates, as a flux in the smelting of copper ores, whether the ores be sulphurets, carbonates, or oxides.

The invention is carried out as follows:—Suppose the ore to be a sulphuret, containing twenty per cent. or upwards of copper, and the quantity to be operated upon to be one ton, which had been previously calcined, and is placed in an ordinary reverberatory smelting surface.—To this quantity of ore, four hundred pounds of whinstone, broken into small fragments, and seventy pounds of coarsely-pulverized coke are to be added, and the operation of smelting is conducted in the ordinary manner. The process is stated to be improved by the employment of barilla, in addition to the whinstone and coke; but, in this case, the quantity of whinstone is reduced: thus, for a sulphuret copper ore, containing twenty per cent. of copper and upwards, if thirty-seven pounds of barilla be used, it will only be necessary to employ two hundred pounds of whinstone. If the ore be a carbonate or oxide, containing twenty per cent. of copper or more, the whinstone and coke are to be used in the proportions above given; but, in addition thereto, the patentee introduces into the smelting furnace fifty-six pounds of limestone and twenty pounds of oxide of iron: the operation of smelting is conducted in the same way as when a sulphuret ore is being treated; but the carbonate or oxide copper ores do not require to be first calcined. Barilla may also be used with advantage when carbonate or oxide ores are to be operated upon; and then only half the above-mentioned quantities of limestone and oxide of iron will be required. When the ores, whether sulphurets, carbonates, or oxides, contain less than twenty per cent. of copper, the proportion of whinstone above given is to be reduced one-third.

Instead of whinstone, iron slag, or trap, basalt, syenite, or other stones of a like nature to whinstone, may be employed in the same proportions. With regard to the other substances before mentioned, the patentee states that he does not confine himself thereto, as he has merely given them as examples of the classes of substances which he intends to employ; and he would use other substances of the same classes, if circumstances should render it advisable: thus the object to be attained by the use of coke is to introduce carbon into the furnace; and, therefore, coarse charcoal or anthracite coal might be substituted. Instead of oxide of iron, calcined black-band ironstone or carbonate of iron might be employed; and kelp might be substituted for barilla.

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* By a Disclaimer, dated 14th September, 1849, the patentee has erased the words " or other " from the title of his patent.

The patentee claims, as his invention, the improvements in smelting copper ores by the use of what is commonly called whinstone or other like stones, broken into fragments, or by the use of what is commonly called iron slag,—all having carbon added, and either with or without alkali,—as an improved flux.—[*Inrolled September,* 1849.]

Scientific Notices.

SUGGESTIONS FOR A NEW HISTORY OF INVENTIONS.

The speed with which the world now becomes familiar with new wonders is not the least wonderful peculiarity of the present age. We are accustomed to greet the first announcement of an important discovery with an incredulous smile; but the truth of this fresh marvel is no sooner confirmed, by its being brought into practical operation, than we (unless personally interested in proving it a failure) immediately avail ourselves of the advantages it is capable of affording, without caring to enquire from what source the invention was derived. However much this power of assimilation may conduce to our individual comforts, and, by the reward it confers on successful projects, stimulate the ingenious to further exertions, it would seem to check the growth and expression of public gratitude to these pacific benefactors of their race, if not to destroy the very germ of that feeling in the heart of the nation. The inventor is, in fact, too generally regarded either as a foolish visionary or a selfish plodder in the fields of science, who, if he succeeds in his speculations, deserves the title of a greedy appropriator of other men's gains rather than a successful reaper in fields hitherto untilled; and, if he fails, merits the contempt which ever attends on failure. It is not our purpose to battle with this erroneous notion, for it is one which time, and time alone, will remove; it is (as we believe) by the very magnitude of the results of modern discoveries, that their several authors are hidden out of sight of the contemporary observer. Men are apt to feel a little humiliation when they reflect that it was the act of one still living and moving amongst them which effected this or that great social reformation; and, therefore, to escape from the unpleasant comparison which they might be induced to draw between such a man's exertions and their own, too many esteem it prudent to banish the subject altogether from their thoughts. But even if the memory of the men who are sacrificing their lives and fortunes to add some fresh link to the chain of our social progress is disregarded, it is not without interest, for such as have a taste for antiquarian research, to trace in imagination the inconveniences to which mankind must, in past ages, have been put, from the want of the numerous modern contrivances which are now generally esteemed as necessities. In taking such a book as Beckmann's History of Inventions for a guide in this enquiry (if it is not thought requisite to search deeper for information) the great advance which modern civilization has made beyond the line of comfort reached by the most polished nations of antiquity, will be soon apparent. To take, for instance, the subject of the lighting of cities, it is curious to follow our author in his comparison of the deficiencies, in this respect, of Imperial Rome, when in her glory, with the improved condition of modern cities when he wrote (about 1780), and to contrast the system which he eulogizes with that which at present exists: the same may also be said of the subject of paving and cleansing streets. Of this kind of antiquarian research, treated, by the way, with anything but a reverence for antiquity, we have a taste in Mr. Macaulay's History of England, when he describes the "plague, pestilence, and famine nuisances" which our forefathers most philosophically bore, not merely in their crowded cities, where there might be some excuse for the retention of inodorous heaps, but even near their country mansions. The pursuit of this enquiry, if it served no other useful purpose, would tend to make us more contented with our lot. There is, however, another manner in which the history of inventions might and ought to be written; for, in addition to the interest which a true picture of the progress of mind never fails to elicit, the work, constructed after our plan, would open out a clue to the unravelling many a difficulty, which has baffled the skill of the most ingenious, and checked the ardour of the most persevering. To give this work an appropriate designation, distinguishing it from all preceding attempts, we should suggest the adoption of the title—*A Natural History of Inventions;* for the distinguishing feature of this history would be, to take the several principles of nature which have been applied by and made useful to mankind, and to trace their individual development through the various branches of mechanical and chemical science. In order to render it generally interesting it might be furnished with striking contrasts, set in juxtaposition, according to the plan on which even sober history, in this fastidious age, is required to be written: there might, with advantage, be introduced into the work the failures as well as the successes of inventors;—for the dark phase of the subject, by depicting shoals, and eddys, and rocks, to be avoided in future, would greatly add to the utility of the history of inventions. Thus the fruitless efforts which were made by successive generations of alchymists, to discover and apply secrets that modern science has proved to have no existence in nature, might be brought under review; and, as a contrasting example of success, some principle which had been discovered by reasoning analogically from certain known facts (instead of resting upon the fond conceit of bewildered imagination), and adopted by experimenters as the basis for their operations, might be adduced, and its applications to the various arts set forth in their successful and diversified forms.

It may be considered that there is little need to warn the present generation against a return to the fallacies of the dark ages of modern Europe,—that a general diffusion of knowledge has put the world into possession of a set of true philosophical principles, which cannot fail to restrain the imagination within rational limits, by giving strength and penetration to the judgment. We are not quite sure that this is the case; we rather fear that an impartial enquiry would demonstrate that, if the belief in the transmutation of metals has passed away with a heap of other antique notions directly opposed to the laws of nature, there are existing at the present day, even in the minds of otherwise intelligent men, fallacies as great, if not as palpable, as those which led thousands of enthusiasts, in the fourteenth and fifteenth centuries, to devote their lives to studies which were calculated to lead to nothing but disappointment. If we are not to put down the greater portion of the failures of modern inventions to a deficiency in their authors of the knowledge of first principles, we know not to what other cause they can be assigned. This point was well set forth in an article on the progress of inventions in a recent number of the *Edinburgh Review*. The writer, in alluding to that great failure of the age—the atmospheric railway—makes the following pertinent remarks:—" It is a fact, equally sad and strange, that, among the very numerous patents relating to the atmospheric railway, there is not one that touches upon the real turning point of the question. What was called the 'longitudinal valve' or opening, through which was established the connection between the piston, travelling within the exhausted tube, and the train of carriages, formed the *pièce de resistance* for inventors: * * * And yet the valve itself entered, but as a subordinate function, into the equation, by which success or failure was to be determined. Granting that its construction was theoretically perfect, and all friction and leakage annihilated, the main principle, which depended upon the laws that govern the motions of elastic fluids, was left wholly untouched." He then proceeds to shew that the experiments of M. Papin, some hundred and sixty years ago, had demonstrated the inaptitude of the principle of atmospheric exhaustion to such a purpose. But how many of the shareholders of the South Devon Railway had heard of M. Papin and his air-pumps? Not one we should think, or the fruitless expenditure of £343,595. 13*s.* 6*d.* (as the Report of the Company gives it), on an attempt at establishing a system of atmospheric propulsion, would surely have been saved. Here, then, is an instance in which our proposed history might have rendered great service;—for, in tracing the application of that law of nature which provides an instant means of filling up a vacuum (unless resisted by the contrivances of man), M. Papin's experiments would have figured amongst others of a similar class; all of which would have gone to prove that the employment of a rush of air as a motive power, when obtained by artificial means, is an inexpedient way of applying the power at command. We have said that this work would not merely be calculated to act as a check upon extravagant propositions, but that it would also help to unravel difficulties which have hitherto baulked the ingenious. This will be readily understood by the following example, to which we must confine ourselves, for the present at least,—leaving to others, whose talents and occupation better fit them for the task, to follow out the plan thus briefly propounded, and to achieve the honor of writing one of the most useful works of the nineteenth century.

Having spoken of vacuum, and of nature being opposed to its existence, we will take it for our illustration. In treating of this principle as the basis whereon inventions might be founded, it would be well to introduce the subject by explaining generally how fluids behave themselves when suddenly presented to a vacuum, and what is the cause of their characteristic actions. The applications of this principle should then be taken in chronological order, beginning, say, with the common pump,—one of the earliest and most important applications of the vacuum principle. Its advantages over other modes of raising fluids might then be briefly stated; and so connected with the description should the particular merits of each application be made to appear. Next would follow* Watt's addition to the steam-engine, of the vacuum condenser, which, by withrawing from one side of the piston of the working cylinder its exhaust steam, destroyed the resistance given to the expanding steam on the other side of the piston; while it allowed of the steam being condensed and returned to the boiler. Howard's evaporating pan, for crystallizing sugar, another application of the same principle of nature, though a a considerable modification from the former two, might then follow. By using air-tight pans, and exhausting the air above the liquid they contained, he created a disposing cause for the steam to rise immediately on its formation, and thereby greatly expedited the process of evaporation. But now, in following the progress of invention link by link, we see the connection of one invention with another; for, by an inversion of this process, Fourdrinier's great improvement in paper-making was obtained: thus, supposing the downward pressure of the air on the saturated paper pulp, when on the wire-cloth or strainer, to be equivalent to the upward tendency of the vaporizing power derived from the heat below the evaporating pan, we have the exhaustion produced under the strainer, extracting the water from the pulp in the same way that the steam was carried off in the former instance. In Fourdrinier's paper-making machine the pressure of the atmosphere was used as an impelling power to drive the water from the pulp. Following this ingenious application of a vacuum for the expulsion of moisture were a variety of others for absorbing moisture, on the same principle. Thus, Mr. Oldham, of the Bank of England, introduced a mode of sizing, dyeing, and wetting paper, by exhausting the air from a pile of paper, and allowing the liquid to percolate through it.† Dyeing in pattern was also effected by the aid of vacuum. A pile of goods (such as handkerchief-pieces) was compressed in an air-tight chest, and a stencil-plate, of any desired pattern, was laid on the top of the pile; dye-liquor was then turned on to the stencil-plate, and an air-pump, connected with the bottom of the chest, being set to work, exhausted the goods of air, and drew down the liquor, through the perforations in the stencil-plate, in streams having the sectional form of the pattern of that plate. A similar plan was proposed by Messrs. Knowleys and Duesbury* for tanning hides and skins; and a carrying out of the same idea is shewn in Mr. Bethell's process for impregnating timber,† and Mr. Payne's for salting provisions:‡ it is also to the same natural law that the action of the common cupping apparatus is due. In the manufacture of felt Mr. Williams found, by means of a current of air, obtained by an exhaust-fan, that he could effect the deposit of the fibrous material with great expedition and compactness;§ and the same principle has been applied for extracting dust and other extraneous matters from cotton and wool while under the dressing operation. It would be almost endless to trace the various modes which have been adopted for applying this principle to blast furnaces, and to ventilation generally; but there are some further applications in the arts which should not be omitted, as they tend to shew how wide a base for the operations of ingenuity this principle is yet calculated to afford. It had long been a desideratum in the grinding of corn to prevent the stones from choking and heating the flour; and many had been the attempts to remedy this difficulty, but without success, until the vacuum principle was applied by a Belgic inventor.‖ According to his improvement the stones were enclosed in an air-tight case, and a shute, made in the side, for carrying off the flour, was brought into connection with an exhaust-pump or fan; down the eye of the runner or top stone the seed was fed as usual, and, when the mill was set in action, the exhaust-pump was likewise actuated, and made to draw a current of air down the eye of the runner and between the grinding surfaces; whereby the particles of flour were expelled, in a cool state, immediately they were produced,—instead of choking up and heating the grinding surfaces. Close upon this followed Mr. Ashby's application of an exhaust-fan to flour-dressers,¶ by which the operation of dressing was considerably expedited;—a current of air being drawn down the wire-gauze cylinder, and made to pass through the meshes thereof with the flour. Familiar examples of the application of this principle of atmospheric exhaustion are furnished us by the domestic utensils now generally employed for obtaining extracts; thus we have, as coffee pots, Beart's, Platow's, Waller's, Skene's, and a number of other contrivances: in fountain-lamps also the same idea is carried out. A very useful application of the vacuum principle has been recently made in the manufacture of glass by Mr. Bessemer. It had heretofore been the practice in polishing plate-glass to prepare a bed of plaster of Paris, to receive the plate and hold it firm, by friction of contact, whilst it was undergoing the polishing operation. The time and cost of preparing this bed Mr. Bessemer saves by the use of a bed-plate or slab, pierced with minute holes, under which an exhaust-chamber is fixed, communicating, by a pipe and tap, with an air-pump, and, by a second pipe and tap, with the atmosphere. To retain the plate of glass upon the bed-plate, the tap of the pipe connected with the air-exhausting pump is turned on; when the air is withdrawn from under the glass, and it is held firmly in its place by the pressure of the atmosphere. When it is required to be released, the tap of the exhaust-pipe is turned off, and that of the pipe communicating with the atmosphere is turned on, whereby air is admitted below the glass;—the pressure of the atmosphere being thus equalized on both sides of the glass, it may be readily removed from the bed-plate. For a still more recent adaptation of this atmospheric principle, we are indebted to the United States; but, as it would be premature to describe this invention, we will merely remark that it refers to the manufacture of shot.

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* It should be understood, that in these remarks we do not pretend either to a perfect list or chronological arrangement of the important inventions dependent on the employment of vacuum or currents of atmospheric air; our object is simply, as above stated, to make the idea we have broached clear to the reader.

† London Jour., Vol. II., p. 36, First Series.

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* London Jour., Vol. I., p. 159, Second Series.

† Ib., Vol. XX., p. 111, Conjoined Series.

‡ Ib., Vol. XXI., p. 104, Conjoined Series.

§ Ib., Vol. X., p. 73, Conjoined Series.

‖ Patented in the name of Newton, and described in London Journal, Vol. XXX., p. 13, Conjoined Series.

¶ Ib., Vol. XXXIV., p. 393., Conjoined Series.

From the above slight survey of the useful applications of one well-known principle of nature, it will be readily understood how wide is the scope for inventors, even if they confine their exertions to the development of those natural laws which are already discovered. It is not to many men in a generation that the faculty is given to dive into the secrets of nature and bring new principles to light; much less is it in the power of man to circumvent nature, or contravene its laws; yet we find the most miserable absurdities frequently put forth in the shape of perpetual motions, flying machines, &c., as if the field for the legitimate exercise of ingenuity were already exhausted. As a counteracting force to such irrational attempts, our proposed *Natural History of Inventions* would, we think, be found of service, 1st, because inventors might find that their premeditated follies had been anticipated; and, 2nd, because a careful study of the connecting links of invention, as traced out and referred to first principles, might be suggestive of further useful applications; while to those who seek to invent under a consciousness of the necessity for improvements, a history of inventions, classed according to the principles on which they are based, and arranged in chronological order—thus forming an index to the greatest achievements of mankind—could not fail to afford such useful hints as would lead them to the attainment of their desired object. It would be useless to disguise the difficulty attendant upon preparing such a work as this,—for it would certainly involve great labor of research; but we are satisfied that the materials are to be found; and examples of industry, equal to the accomplishment of the task, are certainly not wanting. Let us then hope that, in an age so prolific of inventions as the present, some able man in the ranks of literature may be willing to become the recorder of the only triumphs that are calculated to endure, viz.—the triumphs of peace.

REPORT OF THE COMMISSIONER OF PATENTS TO THE SENATE OF THE UNITED STATES,

ON THE SUBJECT OF STEAM-BOILER EXPLOSIONS.

The following Report on steam-boiler explosions, which has recently been prepared by the American Commissioner of Patents, in compliance with a resolution of the Senate of the United States, will be found of considerable interest, as it takes both a philosophical and practical view of the subject; examining the various theories which have been advanced as to the cause of explosions under peculiar circumstances; and shewing the advantages and defects of the several propositions which ingenuity has suggested for insuring greater safety in the employment of steam-boilers. To the Report, as printed by order of the United States Senate, a lengthy Appendix, containing much useful statistical and other matter, is added, together with a number of plates, illustrative of the apparatus employed for testing the strength and expansibility of metals with reference to the subject of explosion,—thus forming a valuable addition to scientific literature. The Report, with some slight curtailments, runs as follows:—

In order to comply, as fully as possible, with the requirements of the resolution of the Senate, a circular was issued by the Patent Office, addressed to the collectors of every port in the United States, and replies have been received from sixty-eight collectors, as well as numerous communications from other sources, with reference to the subject of explosions. The returns are evidently incomplete, as to the number of boats which have been destroyed by the explosion of their boilers during the period stated in the inquiries, and meagre in the details of those accidents, accounts of which are furnished; yet sufficient, perhaps, is stated from which to form a tolerably correct opinion as to the amount of the evil, the causes on which it depends, and the remedies which legislation is competent to apply to it. Such of the results of these inquiries as could be presented in tabular form are given in an appendix. The returns of explosions on railroads are so few and unsatisfactory that they have not been taken into consideration in this report. All the information which the office has received, in regard to these, is also given in the table in the appendix.

The returns received enumerate two hundred and thirty-three explosions of steam-boat boilers; from which accidents the number killed (as given in one hundred and sixty-four cases) is eighteen hundred and five, making an average of eleven for each accident. If the sixty-nine cases, in which the number killed is not stated, average the same, the total loss of life, in the two hundred and thirty-three cases, would amount to two thousand five hundred and sixty-three.

The number wounded, in one hundred and eleven cases, is one thousand and fifteen—an average of nine. The same calculation, as in the former case, would give, as the total number wounded, two thousand and ninety-seven; making the whole number of sufferers four thousand six hundred and sixty.

The amount of pecuniary loss sustained in seventy-five cases is nine hundred and ninety-seven thousand six hundred and fifty dollars, giving an average loss of thirteen thousand three hundred and two dollars by each explosion; which, applied to the whole number of cases, would make the entire loss three millions ninety-nine thousand three hundred and sixty-six dollars.

Of the explosions enumerated, two hundred and two, or ·867 per cent., occurred on the southern and western waters; one hundred and forty-six, or ·626 per cent., on the Mississippi river and its tributaries; ninety, or ·386 per cent., on the Mississippi alone; forty, or ·172 per cent., on the Ohio.

From 1830 to the present time the number of explosions given is one hundred and ninety-eight, making an average of ten each year, with one hundred and ten as the average annual loss of life, and ninety the annual average of wounded; the total number of sufferers, annually, being two hundred, and the annual pecuniary loss one hundred and thirty-three thousand and twenty dollars.

The steam-boat tonnage of the western rivers in 1846 was 249,055, and the whole value of the commerce of these boats sixty-two million two hundred and six thousand seven hundred and nineteen dollars. The probable extent in miles of the steam navigation of the western waters, as estimated by Colonel Long, of the topographical engineers, is sixteen thousand six hundred and seventy-four. The whole number of steam-vessels built in the United States, from 1830 to 1847 inclusive, is nineteen hundred and fifteen. The losses by explosion during the same period amount, according to the returns furnished, to one hundred and ninety-eight, or about ten per cent.

There is something in the appalling nature of steam-boiler explosions which strikes public attention, and has given rise to an impression that steam-boats and railroads are more dangerous modes of conveyance than any others. It is to be regretted that no direct means of making a comparison through a series of years, between the losses by ordinary navigation, and those by steam navigation, are in the possession of the office.

To make a comparison which should be perfectly fair, it would be necessary to take an equal number of steamers and other vessels, having the same route, and exposed in common to the same sources of danger, except those arising from the employment of steam as the motive power. It would be very difficult to obtain the means of doing this; but a general and somewhat loose comparison can be made, which may serve to correct a false impression which undeniably exists with regard to the comparative safety of the two modes of travel. It appears from a statement contained in a memorial addressed to Congress on this subject, that in the year 1839, the number of American vessels lost by ordinary navigation was one thousand and fifty-nine, and that in the month of December alone, of that year, one hundred and eighty-one vessels and one hundred and seventy-nine lives were destroyed. Thus the number of lives lost in that month is nearly double the average annual loss of life by steam-boat explosions, as deduced from the foregoing calculations. A comparison of the number of vessels exposed would not give a fair estimate of the relative danger of the two modes of transportation, because the number of individuals exposed to the dangers from steam transportation is vastly greater in proportion to the number of vessels than those exposed in ordinary navigation.

In speaking thus favorably of the comparative safety of steam navigation, it is not intended to assert that steam has not added, in each individual case, a new element of danger to the means of transportation where it is employed; but in endeavouring to estimate the absolute risk in each kind of navigation we must take into the account every source of danger to which each is subject, and so doing, we find the risk from ordinary navigation to exceed that from navigation by steam. In the case of the former, disasters frequently occur in a distant quarter, in the presence of comparatively few witnesses, and many of them are never noticed by the press. They are regarded as matters of course, the results of natural causes, over which man has no control. In the latter, on the contrary, every circumstance is present which would tend to exaggerate the impression upon the public mind.

It is merely for the purpose of removing an injurious misconception that the comparison just given, which does not pretend to accuracy, has been made.

For the five years ending with 1828, the ratio of explosions to the number of exposures on steam-boat routes from New York city, was one to one hundred and twenty-six thousand two hundred and eleven. In the next five years, ending with 1833, the ratio was reduced so as to shew one to one hundred and fifty one thousand nine hundred and thirty-one: and in the next five years it fell to one to one million nine hundred and eighty-five thousand seven hundred and eighty-seven.

The result of a similar calculation with reference to western navigation is less favorable. In the memorial of a committee on abuses of steam navigation, at Cincinnati, laid before Congress at its last session, the number of lives annually exposed to the dangers of steam navigation is estimated at eight million one hundred and eighty-five thousand. Taking the average annual loss of life on these waters at seventy,* we find its ratio to the whole number of lives exposed, to be one to one hundred and two thousand six hundred and forty-two, and the ratio of explosions to the number of exposures to be one to five hundred and sixty thousand six hundred and sixteen.

From these facts it appears that the dangers of steam navigation on the western waters, though obviously greater than those at the east, still bear a favorable comparison with those of other modes of water conveyance. Yet so much terror has been excited in the public mind, by accidents of this kind, that the prevention of them has (and no doubt properly) been considered by those nations which have made most use of the powerful and useful, though dangerous agency of steam, as calling for special legislative interference. As early as 1817, a committee of the British Parliament was charged with the investigation of the causes of explosions, and much valuable information was elicited by the examination of engineers and others, which they instituted. That committee felt and acknowledged the inexpediency of 'legislative interference with the management of private concerns or property, further than the public safety should demand,' but they urged 'that a consideration of what is due to public safety has, on several occasions, established the principle that where that safety may be endangered by ignorance, avarice, or inattention, against which individuals are unable, either from the want of knowledge or of the power, to protect themselves, it becomes the duty of parliament to interfere.' This principle has been acknowledged also by the French government and by our own. Of the propriety and necessity for legislation of some kind there can be no doubt; the only question is, as to what the character of that legislation ought to be. The determination of this question involves the consideration of the causes of these fatal occurrences, and the remedies which have been proposed.

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* Calculated by the per centage.

The fact that the steam-engine has come into such general use, and has been placed under the management of men widely differing in their education and judgment, and many of them entirely destitute of scientific knowledge, has given rise to a great variety of hypotheses designed to account for the explosions of steam-boilers. Most of them have been mere crude speculations, without any foundation in fact or in physical analogy. Such are the pretended explanations which refer the explosion to the presence of electricity or the generation of hydrogen gas, and its union in explosive proportion with oxygen within the boiler. Of the former hypothesis, it is only necessary to say that electricity, if present at all, would reside on the *outside* of the boiler; and of the latter, that the necessary conditions are not present which would render it probable. In the ordinary condition of a boiler, no hydrogen is produced; and if it were present, it could not procure a sufficient supply of oxygen to combine with it in explosive proportion.*

Another hypothesis accounts for the explosion in this way: the water falling below the fire line in the boiler, the portion of the latter, thus exposed, becomes excessively heated, and communicates its heat to the steam, which thus becomes *surcharged* with heat. Now steam, when heated separately from the water which generates it, follows the law which regulates the expansion of ordinary gases, *i. e.*, it expands $\frac{1}{480}$ part of its bulk (or nearly) for every degree of Fahrenheit above the freezing point. The increase of elastic force is therefore, under these circumstances, very small in proportion to the increase of temperature; but while the steam is thus *surcharged*, a supply of water is sent into the boiler, the surcharged steam at once becomes converted into *saturated* steam of high elastic power, and an explosion follows. This hypothesis, although ingenious, and long received as the true explanation of the phenomenon, is found to be contradicted by the results of careful and repeated experiments. The committee of the Franklin Institute, 'appointed to examine into the causes of the explosions of the boilers used on board of steam-boats, and to devise the most effectual means of preventing the accidents, or of diminishing the extent of their injurious effects,' to whose valuable labours (which have thrown great light upon this whole subject) frequent reference will be made in this report, made a series of experiments in the prosecution of one point of their enquiries, to 'ascertain whether intensely heated and unsaturated steam can, by the projection of water into it, produce highly elastic vapor,' and satisfied themselves that in no case was an increase of elasticity produced by injecting water into hot and unsaturated steam, but the reverse; and, in general, that the greater quantity thus introduced, the more considerable was the diminution in the elasticity of the steam.

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* The production of hydrogen was referred to the decomposition of the water by the heated metal. The conclusions drawn by the Franklin Institute committee, from their experiments, to determine "whether any permanently elastic fluids are produced within a boiler, when the metal becomes intensely heated," are "1. That the gas obtained by injecting water upon the bottom of a boiler which was at a bright red heat, was nitrogen gas with variable quantity of oxygen; it was in fact atmospheric air, deprived by the heated metal of more or less of its oxygen. 2. That this air was derived principally from the current into the boiler when surcharged steam had ceased to be formed, and the boiler was left dry; there will therefore be no such quantity in a working boiler, where the air must be supplied from the cold water thrown in. 3. That water in contact with heated iron in a steam boiler, the surface being in its ordinary state, clean, not bright, *is not decomposed by heat.*" Frank. Journ. vol. xvii, p. 222.

A fourth hypothesis has been advanced in a communication to this office, from Mr. N. Sawyer, mechanical engineer of Baltimore, which may perhaps deserve the test of experiment. It supposes the water in a steam-boiler to be permanently thrown out of level by the unequal pressure on its surface, resulting from the escape of the steam through the throttle valve and at one end, and the consequent diminution of pressure at that point. This alteration of level, of course, exposes a portion of the boiler to become unduly heated, and when the working of the engine is stopped, the restoration of level by gravity brings a quantity of water in contact with the over-heated metal, producing highly elastic steam, which, according to the author, may result in an explosion. The existence of the difference of level, here supposed, is supported by the testimony of Mr. C. Evans, who remarks, in an article on the causes of explosion, that 'wherever the steam is taken from to supply the engine, there will be the greatest ebullition, and the water will be higher there than in any other part of the boiler.' The Franklin committee, in their experiments to ascertain 'whether, on relieving water, heated to or above the boiling point, from pressure, any commotion is produced in the fluid,' found that, 'on making an opening in the boiler, even when the pressure did not exceed two atmospheres, *a local foaming* commenced at the *point of escape*, followed soon by a general foaming throughout the boiler, more violent in proportion as the opening was increased.' Though the difference of level, thus produced, could not, it is believed, be sufficient to account for the production of a quantity of steam great enough to result in an explosion, yet the extent to which it would operate could be determined only by experiment.

An hypothesis which has been lately advanced, and to which the attention of Congress has been asked, in a published letter from its author, addressed to the Honourable John Davis, of the Senate, would not have been noticed here but for the latter circumstance. This explanation of explosion, so far as it can be gathered from the pamphlet in which it is set forth,* attributes the phenomena to the action of liberated caloric, set free by relieving the pressure under which its combination with water is stated to be alone possible. This hypothesis seems to have been suggested by the supposed impossibility of accounting for the phenomena of explosion from the gradually increased elasticity of steam by heat. That a gradual increase of pressure can produce all the effects of the most violent explosions, has been conclusively proved by the experiments of the committee of the Franklin Institute; in which it was shewn that the very effects which, in the pamphlet alluded to, are considered impossible to arise from such a cause, did actually follow the gradually increased tension of the steam. The existence of one sufficient cause, fully supported by the experiments of men so distinguished for scientific ability, as were the members of that committee, renders unnecessary a resort to vague hypotheses, unfortified by facts, having no foundation in physical analogy, and, as in the present case, based upon an assumption in contradiction of a well known physical law. Such hypotheses can only serve to divert the minds of practical men from the true causes of these fatal disasters, and thus still further to embarrass the question of their proper remedy.

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* Pamphlet on "The Causes and Effects of Explosions in Steam Engines," &c., by John Wilder, New York, 1847.

The question of the causes of steam-boiler explosions, if ever solved, is to find its solution in the researches of men of true science, conducted by order of the government, and at its expense. The experiments necessary to its full elucidation require too heavy an outlay to be within the reach of the means of private individuals, or even institutions; and the nature of the interests to be protected have made them, by the acknowledgment of all, a proper object of public appropriation. The most valuable contributions, to our knowledge, of the causes of explosions, have been made by the scientific labors of the committee of the Franklin Institute, undertaken at the request, and prosecuted at the expense, so far as the apparatus was concerned, of the Treasury Department in 1831. The services of the committee were gratuitous, although rendered at the expense of much time and labor; and the chairman, Dr. A. D. Bache, the present superintendent of the coast survey, devoted the greater part of his leisure, during four years, to the investigation. Previous to commencing the experiments, the committee addressed a circular to every engineer known to them as connected with the practical application of steam, and who had any personal knowledge of the explosion of a boiler. The answers to these circulars, though containing many crude hypotheses, furnished a valuable collection of facts and suggestions, which served to guide the researches of the committee. It cannot but be believed that the institution of a new series of experiments on the same subject, conducted in the same spirit, and on the same liberal scale as those of the committee alluded to, would serve to confirm the knowledge already acquired, and throw still further light upon this interesting and important inquiry.

The causes of explosions, as laid down by the committee, are:—

1. Excessive pressure within a boiler, the pressure being gradually increased.
2. The presence of unduly heated metal within a boiler.
3. Defects in the construction of a boiler or its appendages.
4. The carelessness or ignorance of those entrusted with the management of the steam-engine.

The causes, so far as they are stated in the returns to this office, may all be included under one or other of these classes, and they have accordingly been so classified in the summary found at the end of the table of explosions.

How far these causes are correctly assigned, the undersigned is not able to say, as the means by which they were ascertained are not known to this office. It is desirable that in case of future explosions, provision should be made for obtaining full and accurate information of the nature and causes of the accident. Entire reliance cannot be placed on the testimony of ordinary eye-witnesses, however honest their intentions; and still less confidence can be reposed in that of the engineers and officers of the boat on which the accident occurs, as they are directly interested in shewing that it was the result of no dereliction of duty on their part; but, improper influences aside, persons unacquainted with the nature and properties of steam and the steam-engine are not competent to form an opinion, of any value, upon the causes of an explosion; nor are those who have a merely practical knowledge of these matters in a better situation for this purpose;—they have too often preconceived opinions or hypotheses to which they are anxious to make facts agree, and, without intention to deceive, they are apt to seize upon those facts which seem to justify their prejudices, and disregard others of a different tendency. It is to an investigation by scientific men alone,—men who value hypotheses only as they are in accordance with, and serve to account for, facts, and who are ready to abandon them whenever and as often as they are found to conflict with well-ascertained facts,—that we are to look for a satisfactory determination of the causes of these disasters. It might be made the duty of the inspectors of steam-boilers to keep an accurate record of the explosions which occur in their several districts; they might be authorized to procure an examination, in every such case, by persons having the necessary scientific qualifications, and required to report, at stated periods, to an appropriate bureau at Washington. The collating and comparing of the information thus furnished would doubtless lead to valuable deductions, and have an important bearing upon future legislation with reference to this subject. In a great majority of the reported cases it is known that no scientific investigation was had, and the returns, so far as the question of causes is concerned, are probably, therefore, based upon common report, or the mere opinions of engineers.

That '*undue pressure within a boiler, gradually increased,*' is one of the most frequent causes of explosions, has been proved, as well by recorded cases as by the experiments of the committee. One of the points of enquiry to which their attention was specially directed, was to ascertain the sort of bursting produced by a gradual increase of pressure; and, after several decisive experiments, they came to the conclusion that all the circumstances attending the most violent explosions may occur without a *sudden* increase of pressure within a boiler.—This gradually increased pressure may result from the accidental failure of the apparatus intended to relieve it, or from this being intentionally prevented from operating, by the reckless hands which sometimes have the control of it. Of the ninety-eight cases, in which the causes of explosions are stated in the returns, sixteen (being 16½ per cent. of the whole) are assigned to this cause.

The cases referred to '*the presence of unduly heated metal within the boiler*' are also sixteen. The danger attending the over-heating of the boiler arises from the diminished tenacity of the metal thereby produced, which renders it incapable of any longer sustaining the ordinary working pressure; and from the metal being made itself a reservoir of heat, capable of generating an increased quantity of highly elastic steam, as soon as water shall be brought in contact with it.—This over-heating of the boiler may be occasioned by suffering the water to become too low, or by allowing sediment to accumulate on the bottom. The former cause operates by exposing a portion of the surface next the fire to the action of heat while uncovered by water, and the latter by interposing a medium of but low-conducting power between the fire and the water,—thereby suffering the metal to acquire heat faster than that heat can be conveyed to the water. In either case the metal is technically said to be 'burnt'; and even if no serious consequences should occur at the time when such burning takes place, still the tenacity of the metal is thereby permanently diminished, its thickness decreased,* and the liability to explosion, therefore, greatly enhanced. In boilers where flues are employed, their collapse is the ordinary result of this state of things.

The deficiency of water may be in consequence of the pumps being obstructed, so as to throw in less than the requisite supply; or from their being heated, so as to inject steam; or from their not being in action when the engine is stopped and steam blowing off. The sudden removal of these causes of deficient supply, while the intensity of the fire continues at the same time undiminished, is very likely to produce an explosion, for reasons already explained. Hence the great number of these accidents which occur immediately upon starting the engine after a stoppage at a landing, or for repairs. Mr. Evans expresses the opinion that 'eight out of ten explosions take place just at the time of starting from a landing,—the engine making generally but one or two revolutions.'

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* The diminution of tenacity from over-heating was found by the sub-committee, on the strength of materials, to be equal to about one-third of the original strength.

The subject of deposits, in connexion with the over-heating of the metal of the boiler, is one of great importance, and one which is still comparatively open as a field of research. The Franklin committee made it one point of their inquiry to ascertain by experiment the effect of deposits in boilers. They admitted the collection and hardening of such deposits on the bottom of the boiler, and attributed the danger from them to the production of exfoliations of oxide, which gradually reduced the thickness of the metal, or to the weakening increase of temperature in the metal which they permit.

With regard to incrustations and deposits in the interior of steam boilers, it may in general be admitted, that these must differ with the character of the water used. In boilers using 'hard' water, they consist chiefly of the carbonates of lime and iron mixed with oxide of iron; containing, besides, the earthy salts from the water. Boilers using ocean water are found to detect the differences existing in different parts of the ocean in regard to the composition of its water. It appears that certain 'scales' which were taken from the boilers of the United States steamer 'Marcy,' and subjected to analysis by Professor Johnson, were found to collect in the boilers while running over the Bahama Banks; and the experience of the 'Marcy' is confirmed by that of other steamers which have traversed the same tract of the Atlantic. Professor Johnson's analysis shewed this salt to be de-hydrated gypsum, and led him to the application of the acetate of potassa as a solvent.

The introduction of oil or fat into a boiler, may result in the production of another class of deposits, entirely different from the scales above alluded to; and which appear to result from a combination of fatty materials with earthy bases. Such an incrustation was found in the interior of a steam boiler at Burlington, N. J., and was submitted to examination by Professor Johnson, who supposes it to be a species of soap, formed between the earthy oxides and the acids of animal fat.

In streams which, like the Mississippi and its tributaries, flow for thousands of miles through an alluvial country, and which are subject to freshets, not unfrequently producing alterations in depth of from thirty to fifty feet, the quantity of earthy calcareous, and other matters held in suspension, is great, almost beyond conception. Mr. Cist gives the estimate of an intelligent engineer, that in a twelve days' trip on the Mississippi, the quantity of mud injected into the boilers was fifty-one thousand six hundred gallons, by measurement, or over two hundred tons in weight.—This calculation is based upon the supposition that the sediment in the water amounted to ten per cent., a rate said to be below the fact, at least as regards the Mississippi. This sediment, collecting on the bottom of a boiler, becomes, owing to the admixture of calcareous matter with the mud of which it is chiefly composed, hardened by heat to such a degree that very often it can be removed only by the use of a chisel and mallet. Thus hardened, it is liable to crack from unequal expansion, or other cause, when it admits water to come in contact with the overheated and softened metal below. The necessity for constant attention to the condition of the boilers with reference to this matter is sufficiently obvious. The deposits from salt and chalybeate waters are not less dangerous.

The causes of unduly heated metal within a boiler usually operating, are no doubt those which have just been described; yet the Franklin committee were induced, from the evidence before them, to admit the possibility of the metal of a boiler becoming unduly heated, even when in contact with water: the occurrence of such a fact, however, is extremely rare.

About one-third of the cases reported in the returns are attributed to '*defective construction of the boiler and its appendages.*' These defects may be reduced to three classes: 1, defects in the form of the boiler; 2, the use of improper or defective material; 3, bad workmanship. The first class is not noticed as a cause of explosion in the returns to this office. In the second, are embraced fifteen cases; in the last, eight. In eleven others, the particular nature of the defect is not stated.

That the influence of form upon the strength of a boiler must be very great, is obvious. The forms most commonly employed are, the waggon-boiler of Watt, and the cylindrical boiler, either with or without flues. The boiler of Watt is only adapted to very low steam. Of cylindrical boilers, those without flues are most safe—those with flues have the advantage of economizing fuel. Those flues which pass through both heads of the boiler are considered the most safe. Boilers containing small tubes have not been found successful.

The connected boilers which are used on our western boats are incident to a peculiar source of danger; a mere change of position may be the cause of an explosion. The connecting water pipe is at the bottom of the boilers. When the boat careens, the water descends of course to the lower boiler, and leaves the higher ones exposed, in a greater or less degree, to the action of the fire while uncovered by water. The danger from such an exposure has already been pointed out. The use of connected boilers, in the opinion of the Franklin committee, ought to be discontinued.

Boilers with L flues are liable to a similar source of danger. The portion of the flue above the level of the water in the boiler is exposed to the heat of the fire while not in contact with water. Its tenacity is thus diminished, and it is rendered likely to yield to the pressure within the boiler, and collapse.

Boilers with steam chimnies are still employed for the sake of the advantage of having the steam surcharged with heát, so as to prevent condensation in the steam-pipe and cylinder. They differ from those last mentioned only in the fact that the exposure is greater. The source of danger is the same. Two explosions of boilers of this kind, examined by Mr. Ewbank, were identical in the phenomena exhibited. The vertical arm of the L flue, in both cases, was collapsed in the same way,—shewing that the defect is inherent in the form. The Franklin committee recommend the discontinuance of the use of both of these forms.

They also discourage the formation of small spaces to contain water and be surrounded by fire. Such spaces are liable to accumulate deposits, and to become unduly heated by the water being forced out of them by the formation of steam, as in the case of small tubes.

Boilers of irregular forms are necessarily weak; the tendency of a force acting within them equally in all directions would be to bring them to a cylindrical or spherical form.

The use of cast iron as a material for boilers is believed to have been entirely abandoned; but five cases are given in which this material was employed for the *heads* of boilers which exploded; and its use for boiler heads is still, to some extent, persevered in, notwithstanding the warning voice which science and experience have united to raise against it. The question of the safety of the employment of this material for boilers came before the committee of the British parliament, who were charged with the investigation of the causes of explosions in the year 1817; and the testimony against its use, even at that early period in the history of steam navigation, was unequivocal. The use of boilers, or boiler tubes, of cast iron was positively prohibited by the French government in 1828. The operation of casting, however well performed, is an uncertain process; and the defects of structure incident to it, being concealed from view, lead to a false impression of the real strength of the article cast. But, perhaps, a more pregnant source of danger in the case of cast iron heads, lies in the unequal rate of its expansion, as compared with the wrought metal to which it is attached, rendering it constantly liable to fracture or cracking. Mr. Cist, in his valuable communication, mentions a case in which the cast iron heads of a range of seven boilers were all found in pieces when the boilers were taken apart at the head; and remarks, that these heads are generally found in this condition when they are removed from the boilers. The history of six boilers of this kind, which were made at Shippingport, affords a striking proof of the danger arising from the use of such heads. Of these boilers, one was placed on the 'Car of Commerce,' and, although the only new boiler on the boat, it was the only one that gave way. Its after-head was blown out, and the boiler was projected several hundred feet over the bows of the boat into the river. The five others were put into the 'Atlas,' and exploded the same season in a similar manner. The case of the 'Helen M'Gregor' was of the same character. The head of that boat's boiler blew out, and broke into numerous small fragments; killing several persons, and wounding others. Every consideration then, of prudence, and even of common humanity, would seem to dictate the immediate and total abandonment of cast iron as a material for boiler heads.

The question of the relative strength of materials, with direct reference to their use for steam boilers, has been made the subject of a series of elaborate experiments by a sub-committee of the Franklin Institute, of which Professor Johnson was chairman, in whose able report the subject is considered in a light entirely new. In these inquiries, the element of *temperature* in its relation to *tenacity*, has, it is believed, been for the first time fully considered. The practical value of the results of this protracted and laborious research has been admitted by men of science throughout the world. It would be impossible here to give, within any reasonable limits, an abstract of these results; some of the general conclusions to be drawn from them will alone be stated.

The question of the relative merits of copper and iron as materials for steam boilers, is directly affected by the experiments of this committee. The advantages of the former material are, its superior durability, and its high conducting-power, besides the value of the old materials; but, on the other hand, it is found that an increase of temperature is attended invariably with a diminution of strength; the squares of the diminution of strength varying as the cubes of the temperatures. Between the freezing and boiling points it parts with five per cent. of its strength; at 550° Fahrenheit, it loses about one quarter; at 850°, one half, and at 1300° it becomes a viscid, granular, soft, incohesive substance, entirely destitute of tenacity, though it does not absolutely melt under 2000°.

Iron, on the contrary, presents a state of fact directly the reverse, and apparently anomalous; it increases in tenacity with the increase of temperature until it reaches its mean maximum strength at about 570°, at which temperature it is sixteen per cent. stronger than when cold. When this temperature is exceeded, however, its strength rapidly diminishes. An explanation of this effect will be given hereafter. The different modes of manufacture also were found materially to affect the tenacity of iron. Repeated piling and welding is attended with a great increase of strength. Pig iron of a white fracture produced the most cohesive bars; lively grey, dead gray, and mottled metal produced bars inferior to the first by from one to five per cent; and a mixture of all the kinds gave the most unfavorable result, being from five to ten per cent. below the first in tenacity. The difference between the strength of boiler plate cut lengthwise and that cut across, was found to be about six per cent. in favor of the longitudinal over the cross cut. Riveting diminished the strength about one third. Long use and exposure were attended with great loss of strength. Overheating also produced a permanent reduction of tenacity about one third. The thinning of boiler plates by pressure was also made a subject of careful inquiry. It was found to amount in iron to about 16¼ per cent. of the whole area, to take place less in heated than in cold specimens, and to be attended with great weakening of the plate. Fractures at high temperatures took place suddenly, and the section was smooth, flat, and tapering. An important practical result of this investigation is, that boiler iron cannot safely be exposed to a pressure greater than *one fifth* of its standard maximum cohesion: 12,500 lbs. of extension on each square inch of cohesive action may be assigned as the safe working strain of iron boilers.

A result which affords an explanation of the apparent anomaly with regard to the tenacity of iron, before noticed, grew out of a minute investigation of the same subject by Professor Johnson. It is, that iron which has been subjected to a tensile force while heated to a temperature not exceeding 500° or 600° Fahrenheit, (that force being equal to the whole tenacity of the metal *before heating*) will, when again cooled down to the ordinary temperature of the air, be found not only stronger than it was before heating and straining, but also *stronger than it was while hot.* This shews that the increase of tenacity is not due to the presence of heat, as it still remains after the metal is cooled; but probably, to some molecular change in the iron which the increase of temperature allows the tension to produce. This principle has been made the foundation of inventions for the improvement of the manufacture of iron, and of articles formed therefrom, (such as chains, connecting rods, &c.,) and has relation to steam boilers not less than other articles formed of iron; inasmuch as the strain put upon an iron boiler at a high temperature, is proved not so to weaken it, as to render it afterwards liable to rupture by a less force. The same experiments prove that when the temperatures above mentioned are much surpassed, iron begins rapidly to lose not only the acquired additional strength, but also that which it possesses in the cold state, as it came from the hammer or the rolls.

In another respect, the influence of heat upon iron, within the range of temperature above stated, is found to be important. In a report on this subject made to the bureau of construction, equipment, and repairs of the navy department, under date of September 4, 1843, the interesting fact is presented, that a bar or bolt of iron of good quality, when strained lengthwise with such a force as to break it while cold, will, in general, be elongated before it actually breaks, by about 16½ per cent. of its original length; but that the same iron when strained at a high temperature not exceeding 400°, and with a force equal to that which broke it in the cold state, will only be elongated 5¾ per cent., or about one third as much as when the same force had been applied to it cold. This principle, applied to the steam-boiler, shews that there is no danger of reducing the thickness of the sheet of iron by such a force of steam as would place the boiler under the same strain as it would bear when cold.

It is believed that the republication of the whole investigation of the committee of the Franklin Institute, and its wide dissemination among the practical engineers of our country, would be an important service to the cause of public safety.

When the material used for boilers is the best in its general kind, it may still be individually defective in quality. Mr. Cist expresses the opinion, that much of the boiler iron of the west is made from inferior ore, deficient in fibre and tenacity. The case of the Louis Whetsel is mentioned as an illustration, in which the boilers gave way on the first trip, under ordinary pressure; and while containing a sufficient supply of water to preclude the idea of their being softened by heat. The repeated recommendation of a test, to be enforced by law, of the quality of iron used for boilers, indicates the existence of a general conviction, that the quality employed for this purpose is often dangerously inferior. A number of instances are given, in which the boilers or flues were deficient in thickness. Such were the cases of the 'Clyde,' the 'B. Gilman,' the 'Persian,' 'Oronoco,' 'Superior,' 'Missouri,' 'Alton,' 'Majestic,' and others; in all which cases there appears to have been no deficiency of water in the boilers. The steam-boat, 'Cutter,' is recited as a remarkable instance of the danger arising from deficient thickness of iron. In this case the boat was careened to one side, a position always involving danger to the upper boiler from a deficiency of water; yet, the lower flue, (which proved to be the thinnest,) although completely submerged, collapsed,—while the thicker flues on the other side, though unduly heated, did not give way.

Bad workmanship is, doubtless, a frequent source of accident; though, from the nature of the case, full information on this point cannot readily be obtained. Most of the cases in which this cause is distinctly assigned, consist rather of omisions of important parts than of defective work. With reference to repairs, however, there is direct evidence to shew that they are frequently done in great haste, and without a due regard to safety. One case is given, in which an iron boiler was patched with copper rivets; and one in which repairs were made by unpractised apprentice boys, because good workmen could not be immediately obtained.

The fourth cause of explosions given by the report of the Franklin Institute is the '*carelessness and ignorance of those entrusted with the management of the engine;*' and this is that which, in the deliberate opinion of the undersigned, is operative in the great majority of these fatal occurrences. The explosions which have been distinctly attributed to this cause, amount to the large proportion of 32¼ per cent. of the whole number of those in which the cause is given. Yet even this proportion, large as it is, does not give a fair estimate of the extent to which this cause is operative; for the existence of the other causes can also be traced, in a great majority of cases, to criminal neglect, ignorance, or carelessness in some quarter. 'Undue pressure within a boiler,' gradually increased until it exceed the limit of the estimated tenacity of the boiler, (a point very far above its proper working pressure,) while, at the same time the supply of water is sufficient, could scarcely occur otherwise than by neglect in allowing the safety valve to become corroded on its seat, or by intentionally overloading it. 'The presence of unduly heated metal within a boiler, is attributable to a deficient supply of water, which allows some portion of metal which is in contact with the fire to become uncovered; or to deposits, which operate by interposing a non-conducting substance between the metal and the water,—thus allowing the heat to accumulate in the former, and thereby reduce its tenacity. Now the remedies for both these evils are in the hands of the engineer, who cannot fail to apply them, unless through culpable negligence. 'The defective construction of the boiler and its appendages,' is the result of unfaithfulness in the manufacturer, induced, perhaps, by the false economy of the owners with whom he contracts.

It thus appears that all the causes of explosions which have been assigned by the distinguished scientific authority so often cited, may be resolved, without unfairness, into this one—the carelessness or ignorance of those entrusted with the management or the manufacture of the boiler. The whole of this blame does not, however, justly rest upon the engineers in all cases; for there is too much reason to believe that they are often interfered with, in the most unwarrantable manner, in the performance of their duties, by the captains who employ them, and are forced to pursue a course condemned by their judgment and conscience, through fear of losing their situations. The view here taken of the frightful extent to which this cause of explosions operates, is not only a legitimate inference from the statistics given, but is directly borne out by the testimony of the numerous intelligent and practical men who have furnished the office with their opinions in detail. Upon this view are based the recommendations to be hereafter made.

The causes of boiler explosions having thus been briefly considered, the remedies which have thus far been proposed, suggest themselves as the next topic for consideration. These are either mechanical or legal.

The various contrivances to prevent explosions by mechanical means, are known as the 'safety apparatus' of the engine. These contrivances have been well classified as being, first, such as merely indicate danger without relieving it; second, such as are brought into action and relieve the boiler from excess of steam by the force of pressure alone, or by temperature independent of pressure; third, such as are brought into action by deficiency of water, combined with pressure; fourth, such as supply water without indicating either pressure or temperature.

To the first class belong the common syphon gauge of low pressure boilers, the manometer for high pressure boilers, the glass water gauge, the compound water gauge or altometer of Mr. Quinby, his alarm altometer and vaporimeter, the percussion water gauge of Worthington and Baker, together with the common try cocks, and all those instruments which depend on the opening of small valves to sound an alarm.

In the second class may be placed the common safety valve, the safety guard of Mr. Evans, the fusible discs used in France, and the expansion guard of Mr. Wright.

In the third class are to be found the safety apparatus of Mr. Raub, the hydrostatic valve of Mr. Duff, and the interior safety valve of Mr. Easton.

To the fourth class belong the ordinary force pump, the subsidiary pumping engine used in many steam-boats, and the self-acting pumping engine of Mr. Barnham.

The records of the Patent Office shew that no small share of the ingenuity of inventors has been directed to the invention or improvement of safety apparatus for steam-boilers; and yet it could not be said with truth that any of these contrivances have fully met the demands of the public for a perfect safeguard against the fatal explosions so frequently occurring, especially on our western waters. An invention which should meet these demands ought to be prompt, certain, and irresistible in action, under all situations and temperatures; it should be liable to no casual impediment, and placed beyond the reach of improper interference; should indicate the approach as well as the presence of danger, of which it should give some unequivocal warning; should shew the degree of heat and consequent pressure on the boiler from boiling to the highest permissible point; and should give immediate notice of a deficiency of water. It should exhibit its indications in a form obvious and striking; should be self-adjusting, and readily adjustable; simple, enduring, and not too expensive in its construction.

[*To be continued.*]

Academy of Sciences, Paris.

ON THE EMPLOYMENT OF SESQUIBASIC PHOSPHATE OF SILVER, IN ANALYSIS, FOR THE DECOMPOSITION OF ALKALINE AND EARTHY CHLORIDES.

BY M. J. L. LASSAIGNE.

[Translated for the London Journal of Arts and Sciences.]

We are indebted, says M. Lassaigne, to the chemist, M. Chenerix, for the idea of employing sesquibasic phosphate of silver for the purpose of separating chloride of barium from chlorate of baryta in the preparation of this latter salt. By means of this process (which is, however, little employed at present) this salt was first obtained in a state of purity in the laboratory, and the study of its principal properties was greatly facilitated.

The decomposing action exerted by sesquibasic hydrated phosphate of silver upon alkaline and earthy chlorides led M. Lassaigne to test its action:—1st, for separating certain nitrates from alkaline and earthy chlorides; and 2nd, for the separation of the saccharine principles found in combination with chloride of sodium in some organic substances.

The first experiment made by M. Lassaigne was for the purpose of analyzing spring water. It is well known that salts which are soluble in concentrated alcohol consist, principally, of chlorides of magnesium and of calcium, frequently mixed with azotates in greater or less proportion. Being desirous of ascertaining the proportion of azotate of magnesia and chloride of magnesium in a mixture of alchohol with water from a spring in the environs of Paris, M. Lassaigne tested the action of hydrated phosphate of silver upon those two salts. He soon discovered that, by a gentle heat, the chloride of magnesium was completely transformed into chloride of silver, and subphosphate of magnesia insoluble in water,—the azotate remaining in solution, and being obtained by evaporation. This simple method may be employed under a variety of circumstances; for instance, with a mixture of azotate of lime and chloride of calcium. A small quantity of phosphate of silver, however, remained in solution with the alkaline azotate; but this quantity is very small, and may easily be allowed for in a quantitative analysis. The separation of an earthy azotate from a chloride can only be perfectly effected by evaporating to dryness a solution in which an excess of hydrated phosphate of silver has been diluted, and treating the residuum with cold distilled water, in order to separate, by filtration, the insoluble products formed. By proceeding in this manner, M. Lassaigne was enabled to ascertain, with correctness, the small quantity of azotate of magnesia which was mixed with the chloride of magnesium in spring water; and he is of opinion that this process may be put into practice with advantage when analyzing mineral waters.

Another purpose for which M. Lassaigne tested the properties of the same phosphate was the separation of cane or other sugar, mixed with a small quantity of chloride of lime. These two substances, which are soluble in alcohol, are sometimes found in combination in certain organic products. By the action of the phosphate of silver upon a solution of a similar mixture, at the ordinary temperature, insoluble chloride of silver is formed, and also soluble phosphate of soda, which remains mixed with the sugar. Now, the phosphate of soda being insoluble in alcohol at 88 degrees, whilst the sugar, on the contrary, is soluble, it is easy to conceive how separation may be effected by acting with alcohol upon the product evaporated to dryness. Experiments have proved that the sugar, separated by this reaction, no longer contained any traces of chloride of sodium, which had been purposely mixed therewith.

By operating in the cold state, and with promptitude, upon the immediate soluble principles, in order to separate them from the chlorides which they may contain, there is no fear of the reductive action of the organic matter upon a portion of the phosphate of silver.—[*Comptes Rendus.*]

UPON THE ACTION OF SULPHATE OF LIME WHEN EMPLOYED IN AGRICULTURE.

BY M. CAILLAT.

A MEMOIR, having for its object to ascertain the mode of action of sulphate of lime when employed in agriculture, has been submitted to the Academy by M. Caillat. In the first part of his paper he endeavours to shew that the method of incineration employed for obtaining inorganic matters from plants, does not furnish correct results. The weight, he says, of the ashes collected does not represent all the mineral parts; because, at the high temperature at which incineration is effected, there is a loss, in the quantity of nearly all the substances composing the inorganic part of the vegetable; the sulphates particularly, which it may contain, being in great part decomposed and destroyed.

M. Caillat had the idea of treating the remains of plants, such as trefoil, sainfoin, &c., with pure nitric acid, diluted with water, and he succeeded in carrying off nearly the whole of the mineral matters contained therein; so that of 10 grammes weight of substances, the pulp remaining, when washed and dried, burnt with facility, and only left 18, 20, or 22 milligrammes of ashes. This slight residuum is composed of silica and a small quantity of peroxide of iron; two substances which are insoluble in the acid employed. M. Caillat states that this method of treating plants by an acid has always furnished a larger proportion of mineral substances than that obtained from the same quantity of the same plant by incineration; and he has ascertained that certain plants contain a larger quantity of sulphuric acid than had been hitherto ascribed to them. One experiment shewed that the loss of sulphuric acid, occasioned by incineration, arises from the decomposition of a portion of the sulphate of lime: thus, on intimately mixing with wheat starch a certain weight of pure calcined sulphate of lime, and incinerating the mass, the quantity of sulphuric acid contained in the sulphate employed was no longer perceptible in the ashes. M. Caillat proved also, by another direct experiment, that the sulphate of lime, converted into sulphuret of calcium by the influence of the organic matter, at a high temperature, is partially converted into carbonate of lime by the action of the oxygen of the air; which, burning at the same time the sulphur of the sulphuret, and a portion of charcoal interposed, forms sulphurous acid (which is disengaged) and carbonic acid,—a portion of which remains in combination with the lime, facilitating thereby the displacement of the sulphur.

M. Caillat states that, in the second part of his memoir, he will enter upon an examination of the mineral substances of leguminous plants treated with sulphate of lime, and compare them with those of the same kind of plants, grown upon the same ground, but not so treated, with the view of ascertaining whether it may not rationally be concluded that the sulphate of lime penetrates naturally into the plants,—thereby occasioning their development.

M. Caillat, in concluding this notice of the first part of his work, makes an observation upon a fact connected with organography, which he considers to be new. He says that the treatment of the remains of plants by nitric acid allowed him to deprive them, as much as possible, of the silica interposed in the tissue of the epidermis. This he obtained nearly always of a perfect whiteness. On examining, with a microscope, the siliceous pellicles obtained from gramineous plants, which contain, as is well known, a large proportion of that substance in their epidermis, M. Caillat states that he ascertained that the silica is deposited in the cellules of the epidermis in a very curious manner, viz., in the form of bands or strips, which vary in breadth, according to the plant, from 1 to 2-hundredths of a millimetre, and which strips are attached together at their sides;—the edges of these bands are serrated in a very regular manner. This peculiar arrangement of the silica, although not bearing directly upon the subject, M. Caillat thought might be of sufficient importance to merit the attention of the Academy and of physiologists.—[*Ibid.*]

ON THE AURIFEROUS SANDS OF CALIFORNIA.

BY M. DUFRÉNOY.

M. DUFRÉNOY commenced his communication by stating that the French Consul at Monte Rey had sent to the Minister of Foreign Affairs samples of the gold found in California; a portion of which was sent to the *Ecole des Mines*, which gave M. Dufrénoy the opportunity of examining them;—they consisted, 1st,—of two specimens of auriferous earth, collected from the surface of the soil, at two points of the valley of the Sacramento; 2nd,—of auriferous sand, resulting from a pretty careful washing of the above, and in which scales of gold were distinctly visible; 3rd,—of several fragments of quartz and rock, gathered in the alluvion which constitutes that valley; 4th,—of two lumps of virgin gold; and, 5th,—of scales of gold, obtained from three different points of the Sacramento, viz., from the American River, near its junction with the Sacramento; from this same river, at a distance of 48 kilometres* from its mouth; and, lastly, from the river Des Plumes, distant from 60 to 72 kilometres east of the former. These three points extend over about one-fifth part of the valley of the Sacramento, which river takes its rise in Sierra Nevada (the snowy mountains), and flows into the ocean at the port of San Francisco. Its course, which is nearly due east and west, is from 336 to 360 kilometres in length.

The scales of gold from California are much larger than those from the washings of the Ural Mountains and Brazil. They also differ from these latter in respect of their color, which is reddish, and allows of their being readily distinguished. Their composition, according to an analysis made by M. Rivot, is as follows:—

Gold	90·70
Silver	8·80
Iron	0·38
	99·88

The soil of the valley of the Sacramento is light, and soft to the touch, although, on rubbing between the fingers, some gritty particles may be detected, the color of which is a light brown, and which the microscope shews to be almost entirely siliceous matter.

The mass of gold sent to the *Ecole des Mines* weighs 47·9414 grm.: its color is somewhat reddish; and its composition very similar to that of the gold in scales. This gold adhered to white milky quartz, the surface of which was worn like a pebble; it had therefore undergone great friction, but had preserved its original form, which was that of a thick flat irregular vein. The form of this gold, and the presence of the quartz, shew that gold, in its primitive form, is found in veins in quartzose ore.

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* A kilometre is equal to 1000 metres or 1083 yards English.

The schistus fragments, which exist in the alluvion of the valley of the Sacramento, lead to the belief that the mountains containing the auriferous veins are micaceous schist, rather than granite, properly speaking; which is also proved by an examination of the auriferous sands after washing.

Nature of the auriferous sand of California.

The general color of these sands is black;—it will be seen, at first sight, that oxide of iron predominates, and that it is that mineral which imparts the color to them. M. Dufrénoy, consequently, commenced by separating the oxide of iron by means of a magnet: 3 grammes furnished 1·79 gr. of iron or 59·82 per cent. Notwithstanding the separation of this large quantity of iron, the sands still preserved their black color; they appeared, however, to contain a much larger number of scales of gold. On being examined with a microscope, the sands, after being separated from the iron, contained some octahedric crystals, some with bright faces and little worn, the others rounded, but still bright. These crystals, from their form and the color of their dust, appeared to belong to the titaniferous oxide of iron; they were mixed with flat crystals, which, from their hexahedral form and red dust, would appear to be oligistic iron; and, lastly, amongst the black grains irregular, dull, rather soft fragments, were observable, which had all the appearance of manganese.

The titaniferous oxide of iron predominated considerably in this second portion of sand, whilst there appeared to be very little manganese; this second species of iron may readily be distinguished from the iron separated by the magnet: which latter is dull and in fragments, and rusty in some parts.

Mixed with the titaniferous oxide of iron, in the second portion of Californian sand, many crystals of white zircon were found, the forms of which were, 1st, square prisms surmounted by octahedrons with square bases, and reposing upon their angles. 2nd. The same prism presenting, besides the octahedric form, facets resulting from the intersection of the edges common to the octahedron and the prism. 3rd. Prisms of eight faces formed by two square prisms. These crystals are generally short; and, being perfectly diaphanous and totally free from color, they may be taken at first for quartz; but, on counting the number of their faces, which is very easily done with most of them, it cannot be doubted that they belong to a prism with a square base.

Notwithstanding their small dimensions, the formation of these crystals is so perfect that the incidence of many of their faces can be measured. M. Descloiseaux found the angle of the octahedric facets to be 147° 30′, which only differs a few minutes from the value of the corresponding angle in the zircon.

One observation which M. Dufrénoy thought interesting, at least as regards the power of crystallization, was, that the crystals of zircon often contain other crystals, as, for instance, needles of titanium in rock crystal. These crystals, which are frequently of a milky white or even colorless, may be recognized under the microscope by their different tints; some of them being of a hyacinth red. The white zircon, so abundant in the Californian sand, is generally rare, although M. Dufrénoy says it exists in considerable quantity at Zillerthale, in the Tyrol.

The Californian sands contain colorless and clouded hyalin quartz. This quartz, which is always fragmentary, may be recognized by its vitreous and conchoidal fracture; some fragments, of a light blue color, may also be observed, which can be nothing but corundum.

The grains of sand, when washed, are generally 0^{m},00005 in length and 0^{m},00001 in diameter; these dimensions allow of their being separated, or, at least, easily grouped under the microscope. M. Dufrénoy availed himself of this in order to arrive at the different proportions of the elements above pointed out; for which purpose it was only necessary to count them. In the first operation 560 grains were operated upon,—in the second 352; the mean of these two operations furnished the following results:—

Oxide of iron obtained by the magnet	59·82
Titaniferous oxide of iron, oligistic iron, with traces of oxide of manganese	16·32
Zircon	9·20
Hyalin quartz	13·70
Corundum	0·67
Gold*	0·29
	100·00

The difference which exists in the size and form of the grains, and in the specific gravity of each of the elements composing the auriferous sands of California, leads to the conclusion that these proportions only give an approximation to the statement of their composition. They agree, however, very well with the appreciation arrived at from simple inspection, and are interesting from the indications which they furnish respecting the nature of the auriferous soil. It may be observed, besides, that the specific gravity of the sands of California is 4·37, and that the oxide of iron weighs 5·09. These numbers agree very well with the composition above mentioned.

The crystalline state of the titaniferous oxide of iron, and of the zircon, shews that the primitive soil, the destruction of which produced the diluvian auriferous soil of the valley of the Sacramento, is not far distant, and tends to a belief that it belongs to the chain of Snowy Mountains. The perfect preservation of these crystals, and, above all, the peculiar circumstance of their being perfect at both ends, indicate that these rocks are schistus.—In confirmation of this it will be observed, that in granite the crystals adhere to the rock, presenting only one perfect end; in schistus rocks, on the contrary, the crystals, which frequently lie in the direction of stratification, are perfect.—Such are the staurotides and disthenes of Saint Gothard, disseminated through talcous schistus, and the small crystals of tourmaline so frequent in the micaceous schistus of Morbihan.

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* The richness in gold was determined by the dry test.

There is then every reason to believe that the Snowy Mountains which form the western limit of California, are in great part composed of micaceous schistus and talcous schistus.—[*Ibid.*]

ON VITRIFIABLE COLORS.

BY M. L. BOHLEN.

M. **Bohlen** states that seeing the approbation with which M. Wachter's observations on vitrifiable colors for painting on porcelain (especially that of the purple of Cassius) have been received,* and having himself devoted much time and attention to the subject, he thinks the following remarks on the subject will not prove unacceptable.

PURPLE OF CASSIUS.

A preparation of this color, which will be found to yield the most favorable result, may be made as follows:—

1st. Prepare a solution of gold, as neutral as possible, by dissolving ducat gold in four parts of *aqua regia*, evaporating to dryness, dissolving in 10 parts of distilled water, and filtering through fine paper.

2nd. Dissolve 4 grammes of salt of tin in 120 grammes of distilled water.

3rd. Dissolve 4 grammes of gum-arabic in 190 grammes of distilled water.

Take the following quantities of these ingredients:—1 gr. 30 of the gold solution, 0 gr. 80 of the solution of salt of tin, and 1 gr. 30 of that of gum-arabic, and mix these together, in a glass, with alcohol at 90° C., until the liquor becomes cloudy. The gold purple is thus precipitated, and is washed with alcohol at 35°. The precipitate, when dried, has a brownish aspect; and, on depriving it of the gum, by washing and passing it through the fire, a very fine purple is produced.

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* For account of M. Wachter's researches see page 56 of the present Volume.

Another plan is to dilute 30 grammes of a solution of chloride of iron (of the strength indicated in the Prussian Pharmacopœia) with 10 centilitres of distilled water, and produce decomposition by means of a solution of one part of chloride of tin in 10 centilitres of distilled water, until the whole has acquired a greenish hue; then add 18 centilitres more of distilled water. Pure hydrochloric acid is then poured upon gold, and heated to the boiling point; and nitric acid is added until all the gold is dissolved. Excess of acid must be particularly avoided. This solution of gold is diluted with 360 parts of distilled water, and the ferro-stannic solution, produced as above, is added, drop by drop, until all the purple is precipitated. This precipitate has also a brownish appearance after being dried, but gives, on firing, a very good purple.

Although these precipitates furnish a color which is very fine after the firing operation on porcelain, yet they do not produce so apparently brilliant a preparation for sale as those produced by the Paris manufacturers; M. Bohlen therefore prefers to proceed as follows:—He makes a mixture of 4 parts of nitric acid of sp. gr. 1·24 and 1 part of pure hydrochloric acid, to which is added half the quantity of alcohol at 80° C. Pure tin is then introduced, in small quantities, until it ceases to be dissolved. This introduction of the tin must be effected very slowly; besides which, the vessel, containing the mixture, must be immersed in some cooling substance, such as snow or cold water. The liquor, after being carefully decanted, is to be diluted with eighty times its weight of distilled water, and mixed with the solution of gold, prepared by the above-mentioned process. The precipitate is a red purple, which color it preserves after being dried.

The above-named solution of tin must not be prepared and kept in stock very long before it is required for use, as nitric ether would be formed, which may be known by its agreeable smell. The solution will not in that case, by reason of the higher degree of oxidation of the salt of tin, form with the auriferous solution so fine a precipitate as with a recently prepared solution of tin.

In preparing the purple for the purpose of obtaining from it a lively red color, M. Bohlen does not make use of carbonate of silver, as proposed by M. Wachter, but employs the metal itself, finely ground; which is obtained by grinding sheet silver with honey and a few drops of ether, until the metal is reduced to the finest possible state of division; the honey is then removed by washing. The flux used with these purple colors is a glass composed of minium 6, silica 2, and calcined borax 5 parts.

M. Bohlen mentions a curious phenomenon which takes place upon directing electric sparks upon a plate of glass which has been covered with purple of gold, newly precipitated in the same manner as with an ordinary color. The gold is reduced in zigzag lines, in the direction traversed by the spark, producing an effect similar to lightning in the clouds.

CHROME COLOR.

Various recipes are to be met with in chemical works for the preparation of green oxide of chrome; and, amongst others, that which is effected by the decomposition of chromate of potash by sulphur, ammonia, &c. M. Bohlen says he has tried all these recipes; but has never obtained anything but a chrome-green, which was applicable to ordinary purposes, but would not serve for ornamenting porcelain. M. Bohlen prefers to have recourse (although it is more expensive) to the preparation of oxide of chrome by chromate of protoxide of mercury, in such manner as to recover the mercury. The oxide of chrome, thus obtained, is heated, either alone or in combination with hydrate of cobalt, for several hours, until the desired shade has been attained.

It is a question of some interest to know wherein consists the difference presented by oxide of chrome in its practical applications. Chemists state that protoxide of chrome, by whatever process prepared, is perfectly identical in a chemical point of view; and yet experience proves the contrary.

COBALT COLORS.

Every one who has been engaged in the analysis of ores of cobalt knows that this operation is one of the most difficult operations in analytical chemistry. It is, however, a different matter when preparing cobalt colors, when the only thing required is the elimination of the iron. M. Bohlen states that he has had occasion to treat all kinds of cobalt ores, and has always proceeded in the following manner, which has been attended with success:—The ores of cobalt are pulverized in an iron mortar, specially employed for that purpose, and mixed with a fifth of their weight of charcoal powder, and submitted to a red heat under a chimney with a good draft, or in the open air in a Hessian crucible, stirring continually, until the arsenical vapours cease to be disengaged,—which is a very tedious operation, and lasts several hours. Thus prepared, the ore is introduced into an Egersberg crucible, together with a mixture of 4 parts of nitric acid and 1 part of hydrochloric acid; which mixture is diluted with 3 parts of water, and made to boil on an open fire. This operation is repeated three times upon the same quantity of ore,—the proportion of acid being diminished; but care must be taken, at the first, not to let the liquid boil over. The liquor obtained is left to settle; it is again diluted with water and filtered, and the waters of washing are then added, and the whole is evaporated to dryness in capsules. The saline mass, thus obtained, is damped with water, heated, and separated, by filtration, from the residuum, which consists of arseniate of protoxide of iron. The green-colored liquor, which now contains more or less cobalt, iron, nickel, and manganese, is then decomposed in tall precipitating glasses by means of a solution of potash, with great care at first, to avoid an overflowing of the liquor, until the dirty precipitate resulting begins to assume a blue color. It is at this point that care and experience are required, as, otherwise, there would be a loss of cobalt. To the liquor, separated by filtration from the arseniate and carbonate of iron, with which the nickel and manganese were simultaneously precipitated, and which has already assumed a fine red color, more solution of potash is added, until all the cobalt is precipitated; the precipitate is then carefully washed and dried. The hydrated oxide of cobalt, thus obtained, is sufficiently pure for use as a color, and produces the same effect as the preparations made with oxalate of cobalt and caustic ammonia, by means of well known processes.

For painting upon glass and porcelain, especially the latter, the oxide, obtained as above, cannot be employed for these purposes without preparation. The following is the mode of preparing the oxide:—2 parts of carbonate of oxide of cobalt, 2 parts of silica, and 3 parts of oxide of zinc, are mixed, and calcined for two hours in a Hessian crucible, in a blast furnace; after which the product is ground fine in a porcelain mortar:—the blue, thus produced, on being mixed with its own weight of flux, is ready to be applied on the glass or porcelain.

YELLOW COLORS.

If there should be difficulty in obtaining a supply of the pitchblende usually employed for the preparation of uranium-yellow, a fine yellow, for painting on glass or porcelain, may be produced by the following means:—60 grammes of minium, 8 grammes of oxide of antimony, 8 grammes of oxide of zinc, 11 grammes of calcined borax, 16 grammes of silica, 2 grammes of dry carbonate of soda, and 1 gramme of hydrated oxide of iron, are melted together in a crucible, and ground fine in a porcelain mortar.—[*Technologiste.*]

NOVEL MODE OF MANUFACTURING ILLUMINATING GAS.

A VERY interesting experiment was recently tried by MM. Livenais, de Bordeaux, and Dr. Berhardt, at the chemical lectures of the faculty, in Paris, in the presence of several members of the Academy, and many other *savants* and manufacturers. The fact to be demonstrated was, that by the decomposition of grape-skins and wine-lees, in a close vessel, carburetted hydrogen gas would be disengaged, of such a superior quality as to lead to the supposition that it might be used with advantage in place of the gas ordinarily obtained from coal and resin.

Half a kilogramme (about 1 lb. English) upon being put into an incandescent retort, furnished in less than seven minutes 200 litres* of carburetted hydrogen gas. This gas, on being supplied to a burner, burned with a bright white light. It is entirely free from smell, and the flame may be raised to a great height without smoke.

A second experiment, made with dried wine-lees, gave an equally satisfactory result.

By this simple means, any one may manufacture his own gas, in his house, at a very trifling expense.—[*Ibid.*]

LUBRICATING MATERIAL FOR THE AXLES OF RAILWAY CARRIAGES.

Take from 24 to 25 kilogrammes of soda, and dissolve it in from 15 to 16 litres of water, in a small boiler; and when the whole is well dissolved pour it into a wooden vessel, containing from 120 to 150 litres of water, and stir the whole together. Then melt tallow in the proportion hereafter indicated; and, when it is liquified, add to it palm oil, and heat it to the boiling point. When the mixture boils, let it cool slowly, and when it has cooled down to the heat of the hand, pass it through a sieve, letting it drop into the vessel containing the soda solution. While the mass is solidifying it must be well stirred, in order to render it perfectly homogeneous.

Proportions of Palm Oil and Tallow.

Summer.	kilogr.	Winter.	kilogr.	Spring & Autumn.	kilogr.
Palm oil	62·50	Palm oil	87·50	Palm oil	75·00
Tallow	87·50	Tallow	62·50	Tallow	75·00

[*Ibid.*]

LIST OF REGISTRATIONS EFFECTED UNDER THE ACT FOR PROTECTING NEW AND ORIGINAL DESIGNS FOR ARTICLES OF UTILITY.

1849.

Aug. 29. *Stock & Son*, of Birmingham, for a gas-burner.

29. *Sutherland & Murdock*, of Dundee, for a valve-cock or tap.

29. *Thomas Banbury Randle Ball*, of Hill-street, Coventry, watch manufacturer, for an improved watch.

29. *Alexander Symons & Alexis Soyer*, trading under the Firm of *A. Soyer & Co.*, of 5, Charing-cross, in the county of Middlesex, for Soyer's modern housewife's kitchen apparatus.

29. *Alexander Symons & Alexis Soyer*, trading under the Firm of *A. Soyer & Co.*, of 5, Charing-cross, in the county of Middlesex, for Soyer's magic stove.

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* A litre equals about a quart English.

Aug. 30. *William Satchell*, of Uppingham, for a pump and fire-engine.

30. *Henry Holden*, of 29, Liverpool-street, King's Cross, in the county of Middlesex, for a tailor's measure.

Sept. 3. *Hilary Nicholas Nissen & George Phillips Parker*, of 43, Mark-lane, for the "registered cash-envelope."

4. *Andrew Lindsay*, of the Shaw's Water Cotton Spinning Company, Greenock, for a spindle-bearing.

4. *Andrew Lindsay*, of the Shaw's Water Cotton Spinning Company, Greenock, for a spindle-bearing.

5. *Neale & Wilson*, of Grantham, Lincolnshire, engineers, for a racing or stone-cutting machine.

6. *Thomas Stainton & Matthew Stainton*, both of South Shields, in the county of Durham, founders and general smiths, for a windlass.

6. *Augustus Paul & Brothers*, of 10, Boulevart Bonne Nouvelle, Paris, in the Republic of France, jewellers, for an improved needle-threader and case.

6. *John Duley*, of Northampton, iron-founder, for an effluvia-trap.

8. *Betteley & Co.*, of Waterloo-road, Liverpool, engineers, for a block-sheave.

8. *Charles Minshull*, of 3, Weston-street, Southwark, for an improved imperial hame.

15. *William & Charles Eley*, of 40, Old Bond-street, London, for a cartridge-case.

17. *Frederick Gotto*, of Dover, surveyor, &c., for a self-discharging effluvia-trap.

18. *Charles Chapman Clark*, of Reading, Berks, for a self-acting water-closet.

18. *Isaac Benjamin*, of 21, Old Change, Cheapside, merchant, for the "acme brace-front."

19. *Joseph Bell*, of the firm of Cort and Bell, of Leicester, iron-founders, for an effluvia-trap.

19. *C. Gore*, of 3, New Charles-street, City-road, for a gas exhauster.

19. *Foster Porter & Co.*, of 124, Wood-street, Cheapside, City of London, for a spring muffler.

19. *Charles Maschivitz*, of Birmingham, for a letter-stamp.

22. *John Sanders*, of 43, Weaman-street, Birmingham, and *Samuel Rooke, jun.*, of 7, Whittall-street, Birmingham, brass-founders, for a set of dies for forming hollow or tubular rings.

22. *Charles Edward Butler*, of 31, Farringdon-street, for a hearse.

26. *William Wilson*, of 50, King-street, Manchester, ironmonger, for an improved gas retort.

List of Patents

That have passed the Great Seal of IRELAND, from the 17*th August to the* 17*th September*, 1849, *inclusive.*

To Hugh Lee Pattinson, of Scot's House, near Gateshead, in the county of Durham, chemical manufacturer, for improvements in manufacturing a certain compound or certain compounds of lead, and the application of a certain compound or certain compounds of lead to various useful purposes.—Sealed 22nd August.

Rees Reece, of London, chemist, for improvements in treating peat, and obtaining products therefrom.—Sealed 29th August.

Thomas John Knowlys, of Heysham Tower, near Lancaster, Esq., for improvements in the application, removal, and compression of atmospheric air.—Sealed 10th September.

Charles Vignoles, of Trafalgar-square, in the county of Middlesex, civil engineer, for an improved method of preparing or manufacturing peat or turf for fuel,—being a communication from abroad.—Sealed 10th September.

George Fergusson Wilson, of Belmont, Vauxhall, Gent., for improvements in separating the more liquid parts from the more solid parts of fatty and oily matters; and in separating fatty and oily matters from foreign matters; and in the manufacture of candles and night-lights.—Sealed 12th September.

List of Patents

Granted for SCOTLAND, subsequent to August 22nd, 1849.

To James Nasmyth, of Patricroft, near Manchester, engineer, for certain improvements in the method of, and apparatus for, communicating and regulating the power for drawing or working machines employed in manufacturing, dyeing, printing, and finishing textile fabrics.—Sealed 24th August.

Job Cutler, of Birmingham, for certain improvements in the manufacture of metallic tubes or pipes.—Sealed 28th August.

Henry Gilbert, of Suffolk-place, Pall-mall East, London, surgeon, for an improved mode or improved modes of operating in dental surgery, and improved apparatus or instruments to be used therein.—Sealed 28th August.

James Robinson, of Huddersfield, orchil and cudbear manufacturer, for improvements in preparing or manufacturing orchil and cudbear.—Sealed 29th August.

William Chambers Day, of Birmingham, iron founder, for improvements in machinery for weighing.—Sealed 29th August.

Robert William Thomson, of Leicester-square, London, civil engineer, for certain improvements in writing and drawing instruments.—Sealed 31st September.

John Holland, of Larkhall Rise, Clapham, Surrey, for a new mode of making steel,—being a communication.—Sealed 11th September.

Edwin Heywood, of Glasburn, Yorkshire, designer to Messrs. Thomas and Matthew Baerstow, of Sutton, Yorkshire, for improvements in plain and ornamental weaving.—Sealed 11th September.

Robert Plummer, of Newcastle-on-Tyne, manufacturer, for certain improvements in machinery, instruments, and processes employed in the preparation and manufacture of flax and other fibrous materials.—Sealed 12th September.

William Boggett, of St. Martin's-lane, London, for improvements in heating and evaporating fluids, and in obtaining and applying motive power.—Sealed 14th September.

John Goodier, of Mode Wheel, Manchester, for certain improvements in mills for grinding wheat and other grain.—Sealed 17th September.

William Edward Newton, of the Office for Patents, 66, Chancery-lane, civil engineer, for certain improvements in steam boilers, —being a communication.—Sealed 17th September.

Alexander Haig, of 52, Smith-street, Stepney, London, engineer, for improved apparatus for exhausting and driving atmospheric air and other gases, and for giving motion to other machinery. —Sealed 18th September.

Sir John Mac Neill, Knight, of Dublin, and Thomas Barry, of Lyons, near Dublin, mechanic, for improvements in locomotive engines, and in the construction of railways.—Sealed 19th September.

William Henry Phillips, of York-terrace, Camberwell, New-road, London, engineer, for improvements in extinguishing fire, in the preparation of materials to be used for that purpose, and improvements to assist in saving life and property.—Sealed 19th September.

New Patents
SEALED IN ENGLAND.

To Josiah Marshall Heath, of Hanwell, in the county of Midlesex, Gent., for improvements in the manufacture of steel. Sealed 6th September—6 months for inrolment.

Sir John Mac Neill, Knight, of Dublin, and Thomas Barry, of of Lyons, near Dublin, mechanic, for improvements in locomotive engines, and in the construction of railways. Sealed 6th September—6 months for inrolment.

Alexander Robert Terry, of Manchester-street, Manchester-square, engineer, for improvements in the manufacture or preparation of fire-wood. Sealed 6th September—6 months for inrolment.

Alexander Haig, of Smith-street, Stepney, engineer, for improved apparatus for exhausting and driving atmospheric air and other gases, and for giving motion to other machinery. Sealed 6th September—6 months for inrolment.

John Hosking, of Newcastle-upon-Tyne, engineer, for an improved pavement. Sealed 6th September—6 months for inrolment.

Benjamin Goodfellow, of Hyde, in the county of Chester, engineer, for certain improvements in steam-engines. Sealed 13th September—6 months for inrolment.

Henry Attwood, of Goodman's Fields, in the county of Middlesex, engineer, and John Renton, of Bromley, in the same county, engineer, for certain improvements in the manufacture of starch, and other like articles of commerce, from farinaceous and leguminous substances. Sealed 13th September—6 months for inrolment.

David Stephens Brown, of the Old Kent-road, Gent., for certain improvements in apparatus or instruments for the fumigation of plants. Sealed 13th September—6 months for inrolment.

Richard Archibald Brooman, of 166, Fleet-street, London, patent agent, for certain improvements in draught-horse saddlery, harness, and saddle-trees,—being a communication. Sealed 13th September—6 months for inrolment.

Apoleon Pierre Preterre, of Havre, in France, for improvements in the construction of coffee and tea pots, and in apparatus for cooking, and in apparatus for grinding and roasting coffee, —being a communication. Sealed 13th September—6 months for inrolment.

Edme Augustin Chameroy, of Rue du Faubourg St. Martin, in the City of Paris, for a new system of railway, denominated (helicoide) helical railway, and a circular chariot. Sealed 13th September—6 months for inrolment.

Edwin Heywood, of Glusburn, in the county of York, designer, for improvements in plain and ornamental weaving. Sealed 13th September—6 months for inrolment.

Robert Griffiths, of Havre, engineer, for improvements in steam-engines and in propelling vessels. Sealed 13th September—6 months for inrolment.

Thomas Marsden, of Salford, in the county of Lancaster, machine maker, for improvements in machinery for hackling, combing or dressing flax, wool, and other fibrous substances. Sealed 13th September—6 months for inrolment.

James Potter, of Manchester, mechanist, for certain improvements in spinning and doubling machinery. Sealed 13th September —6 months for inrolment.

William Edwards Staite, of Lombard-street, in the City of London, Gent., and William Petrie, of King-street, Gent., for improvements in electric and galvanic instruments and apparatus, and in their application to lighting and to motive purposes. Sealed 20th September—6 months for inrolment.

David Owen Edwards, of Sydney-place, Brompton, surgeon, for improvements in the application of gas for producing and radiating heat. Sealed 20th September—6 months for inrolment.

Benjamin Wren, of Yarm, in the county of York, miller, for an improvement in cleansing and treating certain descriptions of wheat. Sealed 20th September—6 months for inrolment.

Josiah Lorkin, of Ivy-lane, in the City of London, merchant, for an improved instrument or apparatus for beating or triturating viscous or gelatinous substances. Sealed 20th September—6 months for inrolment.

William Peace, of Haigh, near Wigan, in the county of Lancaster, and Edward Evans, of Wigan, aforesaid, engineers, for improvements in steam-engines, and in pumps. Sealed 20th September—6 months for inrolment.

John Baptiste Vuldy, of Mile End, in the county of Middlesex, dyer, for improvements in giving a gloss to dyed silk in skeins or hanks. Sealed 20th September—6 months for inrolment.

William Edward Newton, of the Office for Patents, 66, Chancery-lane, civil engineer, for certain improvements in pumps, and in machinery or apparatus for working the same; which latter improvements are also applicable for working other machinery, —being a communication. Sealed 20th September—6 months for inrolment.

Charles Marsden, of the Kingsland-road, marble paper maker, for improvements in traps to be applied to closets, drains, sewers, and cesspools. Sealed 20th September—6 months for inrolment.

Thomas Griffiths, of Islington-row, Birmingham, manufacturer, for improvements in the manufacture of tea and other pots and vessels, and other articles made of stamped metal. Sealed 20th September—6 months for inrolment.

William Handley, of Chiswell-street, Finsbury, confectioner, George Duncan, of Battersea, engineer, and Alexander Mc Glasham, of Long Acre, engineer, for improvements in the construction of railway brakes. Sealed 20th September—6 months for inrolment.

Henry Bessemer, of Baxter House, Old St. Pancras-road, engineer, for improvements in the preparation of fuel, and in apparatus for supplying the same to furnaces. Sealed 20th September—6 months for inrolment.

Elijah Galloway, of Southampton-buildings, Chancery-lane, engineer, for improvements in furnaces. Sealed 20th September —6 months for inrolment.

Joseph Rocke Cooper, of Birmingham, gun and pistol maker, for improvements in fire-arms. Sealed 20th September—6 months for inrolment.

John Meadows, of Princes-street, Coventry-street, in the county of Middlesex, carver and gilder, for improvements in veneering. Sealed 27th September—6 months for inrolment.

John Marriott Blashfield, of Millwall, Poplar, in the county of Middlesex, Roman cement manufacturer, for improvements in the manufacture of manure. Sealed 27th September—6 months for inrolment.

William Browne, of St. Austell, in the county of Cornwall, mine agent, and Richard Rowe Veale, of St. Columb Major, in the said county, Gent., for improvements in preparing for pulverization flint-stone, china-stone, ores, minerals, spas, sands, earths, and other substances. Sealed 27th September—6 months for inrolment.

Nicholas Doran Maillard, of Edward-street, Portland-place, engineer, for improvements in obtaining motive power for giving motion to machinery, and in propelling vessels. Sealed 27th September—6 months for inrolment.

William Boggett, of St. Martin's-lane, in the county of Middlesex, Gent., for improvements in heating and evaporating fluids. Sealed 27th September—6 months for inrolment.

William Edward Newton, of the Office for Patents, 66, Chancery-lane, civil engineer, for improvements in the manufacture of knobs for doors, articles of furniture, or other purposes; and in connecting metallic attachments to articles made of glass or other analogous materials,—being a communication. Sealed 27th September—6 months for inrolment.

Disclaimers and Amendments
OF PARTS OF INVENTIONS
MADE UNDER LORD BROUGHAM'S ACT.

Disclaimer filed with the Clerk of the Patents for England, on the 14th day of September, 1849, to part of the title of a patent granted on the 14th day of March, 1849, to Francis Hay Thomson, of Hope-street, in the City of Glasgow, in North Britain, Doctor of Medicine, for his invention of "an improvement or improvements in smelting copper or other ores,"—whereby he disclaims the words "*or other.*"

Disclaimer filed with the Clerk of the Patents for England, on the 5th day of September, 1849, to part of the title of a patent granted on the 5th day of March, 1849, to Nathan Defries, of Grafton-street, Fitzroy-square, civil engineer, and George Brooks Pettit, of Brook-street, New-road, in the county of Middlesex, gas-fitter, for their invention of "improvements in applying gas to heat apparatus containing fluids, and in heating and ventilating buildings; also improvements in gas fittings and apparatus for controlling the passage of gas,"—whereby they disclaim the words "*also improvements in gas fittings and apparatus for controlling the passage of gas.*"

CELESTIAL PHENOMENA FOR OCTOBER, 1849.

D.	H.	M.	
1			Clock after the ☉ 10m. 21s.
	—		☽ rises 5h. 41m. A.
	—		☽ passes mer. 11h. 43m. A.
	—		☽ sets 4h. 43m. M.
2	5	33	Ecliptic oppo. or ○ full moon
	18	51	♅ in conj. with the ☽ diff. of dec.
5			Clock after the ☉ 11m. 34s.
	—		☽ rises 7h. 41m. A.
	—		☽ passes mer. 2h. 18m. M.
	—		☽ sets 9h. 44m. M.
	—		Occul. 48 Tauri, im. 11h. 38m. em. 12h. 42m.
	—		Occul. γ Tauri, im. 13h. 40m. em. 14h. 53m
	—		Occul. θ¹ Tauri, im. 18h. 24m. em. 19h. 28m.
	—		Occul. θ² Tauri, im. 18h. 30m. em. 19h. 24m.
	22	0	☽ in Perigee
6			Occul. 115 Tauri, im. 17h. 49m. em. 18h. 42m.
	5	19	♂ in the ascending node
7	10	7	♂ in conj. with the ☽ diff. of dee. 4. 37. N.
	19	53	☿ greatest hel. lat. S.
9	0	44	☽ in □ or last quarter
	11	28	♀ in conj. with ♃ diff. of dec. 0. 10. N.
10			Clock after the ☉ 12m. 58s.
	—		☽ rises Morn.
	—		☽ passes mer. 7h. 5m. M.
	—		☽ sets 2h. 46m. A.
11	15	25	♃'s first sat. will im.
12	16	30	☿ stationary
		40	♃'s second sat. will im.
	17		♃ in conj. with the ☽ diff. of dec, 0. 0.
	23	19	♀ in conj. with the ☽ diff. of dec. 0. 3. S.
15			Clock after the ☉ 14m. 9s.
	—		☽ rises 5h. 14m. M.
	—		☽ passes mer. 11h. 18m. M.
	—		☽ sets 5h. 11m. A.
	18	48	Vesta in □ with the ☉
16			Mercury R. A. 14h. 23m. dec. 17. 50. S.
	—		Venus R. A. 11h. 26m. dec. 5. 2. N.
	—		Mars R. A. 6h. 11m. dec. 23. 45. N.
	—		Vesta R. A. 7h. 37m. dec. 19. 44. N.
16			Juno R. A. 11h. 49m. dec. 0. 40. N.
	—		Pallas R. A. 17h. 54m. dec. 6. 30. N.
	—		Ceres R. A. 18h. 37m. dec. 29. 22. S.
	—		Jupiter R. A. 11h. 1m. dec. 7. 16. N.
	—		Saturn R. A. 0h. 15m. dec. 1. 10. S.
	—		Georg. R.A. 1h. 31m. dec. 8. 52. N.
	—		Mercury passes mer. 0h. 43m.
	—		Venus passes mer. 21h. 47m.
	—		Mars passes mer. 16h. 30m.
	—		Jupiter passes mer. 21h. 19m.
	—		Saturn passes mer. 10h. 34m.
	—		Georg. passes mer. 11h. 49m.
	5	13	Ecliptic conj. or ● new moon
	15	31	♃'s third sat. will im.
	18	47	☿ in conj. with the ☽ diff. of dec. 7. 53. S.
17	7	13	♅ in oppo. to the ☉
18	17	18	♃'s first sat. will im.
20			Clock after the ☉ 15m. 6s.
	—		☽ rises 10h. 39m. M.
	—		☽ passes mer. 3h. 11m. A.
	—		☽ sets 7h. 39m. A.
	13	2	♀ in Perihelion
	15	0	☽ in Apogee
23	6	58	♀ in conj. with Juno
24	5	0	☿ in inf. conj. with the ☉
	7	4	☽ in □ or first quarter
25			Clock after the ☉ 15m. 48s.
	—		☽ rises 2h. 18m. A.
	—		☽ passes mer. 7h. 8m. A.
	—		☽ sets Morn.
26	19	29	☿ in the ascending node
28			Occul. 27 Piscium, im. 4h. 2m. em. 5h. 1m.
	—		Occul. 29 Piseium, im. 5h. 58m. em. 6h. 54m.
	15	47	♄ in conj. with the ☽ diff. of dec. 0. 1. N.
29			Juno in the ascending node
30			Clock after the ☉ 16m. 11s.
	—		☽ rises 4h. 33m. A.
	—		☽ passes mer. 11h. 12m. A.
	—		☽ sets 4h. 47m. M.
31	4	46	Ecliptic oppo. or ○ full moon.
	9	4	☿ in Perihelion
	—		Occul. B.A.C. 845, im. 6h. 28m. em. 7h. 24m.

J. LEWTHWAITE, Rotherhithe.

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No. CCXV.

RECENT PATENTS.

To William Henry Balmain *and* Edward Andrew Parnell, *both of Saint Helens, in the county of Lancaster, manufacturing chemists, for improvements in the manufacture of glass, and in the preparation of certain materials to be used therein; parts of which improvements are also applicable to the manufacture of alkalies.*—[Sealed 5th March, 1849.]

This invention relates, in the first place, to processes for manufacturing silicate of soda, silicate of potash, silicate of barytes, and double silicates of these bases, by heating their respective sulphates with sand and carbonaceous matter. The patentees are aware that glass is made by heating a mixture of sand, sulphate of soda, charcoal, and lime or limestone; but they find that it is advantageous to make silicate of soda in the first instance, and afterwards convert that into glass by fusion with the proper materials.

In making silicate of soda, the patentees use such proportions of materials as shall produce a silicate containing either about 20 or about 12 per cent. of soda. To make a silicate of soda of about 20 per cent., they mix 3 cwts. of sand, 2 cwts. of dry sulphate of soda, in fine powder, and from 16 to 18 lbs. of finely-ground charcoal, and heat the mixture to whiteness in a furnace, constructed as hereinafter described, or by any of the means in ordinary use. As the silicate of soda falls from the furnace it is received into a vessel of water, which renders it more easy to grind, and, by dissolving the excess of sulphate of soda, presents that substance in a convenient form for being recovered. To make a silicate of soda of 12 per cent., 3 parts of sand and 1 part of sulphate of soda are mixed, and the mixture is heated (with occasional stirring) in an ordinary reverberatory furnace. If the fire be properly managed, the deoxidizing power of the flame will be sufficient to effect the decomposition of the sulphate, without the addition of any other form of carbonaceous matter; and, by exposure to a low red heat for from six to ten hours, a perfect silicate of soda will be formed. In case imperfect work should give a result containing a little undecomposed sulphate, this may be removed by washing with water.

In making silicate of potash, the patentees proceed in exactly the same way as in making silicate of soda,—the relative weights of the materials being altered to accommodate them to the combining equivalent of potash. Thus a silicate of potash of 26 per cent. is made by heating 3½ cwts. of sand, 2½ cwts. of sulphate of potash, and 18 lbs. of charcoal. A silicate of potash of 14 per cent. may be made by using, as above described, a mixture of 9½ cwts. of sand and 3 cwts. of sulphate of potash.

In making the double silicates of the bases above mentioned, the patentees proceed in the same way, adapting the proportionate quantity of sand and charcoal to the combining equivalents of the two bases, and using, when the materials are to be fluxed in the improved furnace, a single equivalent of charcoal to each equivalent of sulphate, and three equivalents of sand to one of base; but they do not confine themselves to such proportions. In some cases it will be found advantageous to use one base in the state of sulphate and the other in the state of carbonate or in the uncombined state. In such cases they use a mixture of sulphate, sand, and charcoal, in the proportions above mentioned, and add to it the base, or the carbonate of the base, with its equivalent quantity of sand, but without any additional charcoal,—the latter substance being only required when a sulphate is to be decomposed. For instance,—to make a double silicate of soda and barytes either of the following mixtures may be used:—

No. 1.—273 parts of sand
72 „ sulphate of soda
117 „ sulphate of barytes, and
12 „ charcoal

No. 2.—273 parts of sand
72 „ sulphate of soda
99 „ carbonate of barytes, and
6 „ charcoal

In all these cases, when it is desirable that the result should be fluxed or vitrified, the mixture is heated, by preference, in the kind of furnace hereafter described; but, when the material is not to be fluxed, it may be heated in an ordinary reverberatory furnace.

It is important to observe, that slight circumstances, as rapidity of work, strength of blast, &c., given to the furnace, may render it desirable to increase or diminish, slightly, the quantity of charcoal. This alteration may be accurately made by an observant workman. A flow of sulphate indicates want of charcoal, and a brown color in the result shews that too much charcoal is present; but it is also necessary to note, that both these effects may be produced by too low a heat in the furnace—which must be guarded against: the best working temperature is a fair white heat. It is also useful to observe, that the addition of 5 or 10 per cent. of common salt to the raw mixture greatly facilitates the fluxing of the materials used, and is not injurious to the result; and, further, that it is important that the alkaline sulphate should be in a finely divided state: the patentees use it of such fineness as to pass through a sieve of twelve holes to the linear inch.

These improvements relate, in the second place, to the use of a sulphuret or hyposulphite in the place of carbonaceous matter, and also in the place of charcoal, in making glass. The substitution of a sulphuret or a hyposulphite instead of charcoal as a deoxidizing agent, to decompose the sulphate, in making glass, is sometimes more economical, and is further desirable, on account of the evolution of less gas than when charcoal is used, and because the combination of the materials takes place more rapidly. The patentees' mode of proceeding is simply to substitute the sulphuret or hyposulphite for the charcoal in the above-mentioned mixtures,—the amount of sulphate used being reduced in quantity (or that of sand increased) equivalent to that of the sulphuret or hyposulphite used. Half an equivalent proportion of sulphuret, or a single equivalent of hyposulphite, should be used in the place of each equivalent of charcoal; although the patentees do not confine themselves to the exact proportions. Thus 20 parts of sulphuret of sodium would be employed instead of 6 parts of charcoal; or a silicate of soda, of about 20 per cent., may be made with 40 parts of protosulphuret of sodium, 144 parts of sulphate of soda, and 418 parts of sand.

In making glass, or a double silicate, either of the bases may be used in the form of sulphuret: hence the applications which may be made of this principle (that is, the conjoined use of a sulphuret and a sulphate in glass-making) are of a varied nature. To produce soda-lime glass, for example, by the use of a sulphuret on the above principle, either of the three following mixtures may be used:—1. Sand, with sulphate of soda, sulphuret of sodium, and lime. 2. Sand, with sulphuret of sodium, sulphate of lime, and sulphate of soda. 3. Sand, with sulphuret of calcium (or hyposulphite of lime), and sulphate of soda. When the sulphuret is readily soluble in water the patentees prefer to mix it with the other materials in concentrated solution; by which course they are enabled to distribute it perfectly and readily throughout the other materials; but, if it is not readily soluble, they reduce it to a state of moderately fine division by any of the ordinary means of crushing or grinding.

The sulphurets may be procured by any of the well-known processes. In making sulphuret of sodium, it is preferred to heat the ordinary materials, namely, sulphate of soda and small coal, in the improved fluxing furnace, in the manner hereinafter described. If the materials used in this operation are sufficiently free from iron, the sulphuret thus obtained may be used for the production of a silicate or glass, without any further preparation than grinding. But, on account of the presence of iron, and also for the sake of extracting the carbonate of soda (which is present) in the manner afterwards described, it is preferred to lixiviate the sulphuret in the ordinary way, and "boil down" the solution until all the carbonate, sulphate, and muriate, which may be present, "fall" or "salt out," leaving a nearly pure solution of sulphuret (with some bisulphuret) of sodium.

Sulphuret of barium, which may be economically prepared and easily obtained in crystals, has the advantage over the native carbonate and sulphate of being free from iron.

The impure sulphuret of calcium or hyposulphite of lime, produced when lime is used for purifying ordinary coal-gas (in the "dry-lime process"), is a convenient source of that substance. The patentees are aware that the refuse lime of gas-works has been used in making common bottle glass; but hitherto it has only been used as a cheap source of lime, without regard to its deoxidizing power, which has been allowed to be more or less injured by exposure to air. They only claim the use of this article when it is employed in the place of charcoal, or as sulphuret of calcium or hyposulphite of lime, to perform the function of a deoxidizing agent, in the manner just related. Mixtures of this kind may be used for producing glass at one operation, in the manner now commonly practised; as is the case supposed in the illustration given above of the modes of producing soda-lime glass on this principle; but, in some cases, particularly in the manufacture of flint glass, it is preferable to divide the making of glass from the above materials into two operations: that is, first to make a silicate or rough glass, which may best be done in a furnace, and afterwards to melt and "fine" the silicate or glass in a pot, as usual, either mixed or not with any additional materials, as the case may require. This mode of procedure also admits of a great variety of modifications, which it would be superfluous to specify; but that the peculiarity of the operation may be properly understood, the following description is given of a case of this kind, relating to flint glass, and consisting in the preparation of a double silicate of barytes and soda:—For this purpose, let 84 parts of crystallized sulphuret of barium, 144 parts of sulphate of soda, and 410 parts of sand, be well mixed together and heated to whiteness in the furnace hereafter described: the product is a double silicate of barytes and soda, which should contain, if the process has been properly conducted, about 14 per cent. of soda and 11 per cent. of barytes, in a fit state for use in the manufacture of inferior flint glass,—being mixed for that purpose with such proportions of sand, red lead, &c., as the glass-maker prefers.

These improvements relate, in the third place, to a furnace of peculiar construction, applicable to the manufacture of glass and certain silicates, sulphurets, &c.

An advantageous form of the furnace is represented in Plate IX. Fig. 1, is a longitudinal vertical section of the furnace; fig. 2, is a sectional plan, taken in the line *a*, *b*, fig. 1; and fig. 3, is a vertical section of the same, taken in the line *c*, *d*, fig. 1.

The furnace consists of a fire-place *n*, built after the manner of ordinary reverberatory furnaces, and two inclined beds or flues *o*, *o*, over or through which the fire plays. The fire-place and beds or flues are made of the most refractory materials: it has been found convenient to construct the bottom and covering of the inclined beds or flues of blocks made of fire-clay. The beds or flues are supported on wrought-iron bearers *p*, *p*, (the space underneath the beds being open at the sides); and the ends of the bearers are supported in brickwork. One fire-place may be made to heat a number of these working beds or flues. The plan of covering with blocks is adopted to avoid the expense and inconvenience of "bracing;" but, in other respects, an arched roof is preferred. The necessary degree of incline and length of bed will vary with the nature of the materials to be worked,—being dependent on the fusibility of the result, and the time required for the chemical action. With a very fusible material the bed may be horizontal,—sufficient inclination being given by the material in its flow. It is not essential that the flow of material should be towards the fire; but it is found most advantageous in all cases where it is important that the result should be in a highly finished state.

The materials are introduced at the top of the inclined beds or flues through an opening *r*, in the roof, by a moveable hopper, shewn detached at fig. 4. The supply of material may be continuous or interrupted, according to the convenience of the workman.

In making rough glass or a silicate, it is preferable to introduce from 20 to 25 lbs. of raw mixture at a time, which may be repeated about every ten minutes. When the charge has been introduced, the hopper is removed, the charge levelled by a bent rod, introduced through a hole in the side *s*, figs. 1, and 2, and the small opening in the roof is covered with a brick. As the materials become melted, they flow down the inclined bed, and are allowed to fall out in a fluxed state at or near the bottom, *i. e.*, near the fire-bridge *t*,—an opening being left for that purpose, either in the side or in the bottom of the flues *o*, as shewn at *v*, figs. 1, 2, and 3. The fluxed silicate or glass is received in a vessel of water *w*, placed immediately underneath, by which it is disintegrated, and better fitted for subsequent melting in the glass-house pot. This furnace may be worked with an ordinary chimney-draft; but it is preferred to produce a blast of air by a circular fan, from which the blast is conveyed by a pipe or flue, terminating in the ash-pit, about a foot below the fire-bars, as shewn at *x*, fig. 1. When the blast is used, the front of the ash-pit is closed by a door. The arrangement of fire-bars and bearers (whether the blast is used or not) may be exactly similar to that of the common reverberatory furnace. The details of this furnace may be varied considerably without affecting the principle of this part of the invention; which consists in effecting such a construction as shall cause each portion of the material to be removed from the sphere of action as soon as the heat has caused the necessary decomposition and combination;—the product being caused to flow by its own weight, when in a fluxed state, either altogether out of the furnace or into a heated reservoir or pot.

When the product is used for glass-making, it is either allowed to drop into water, that it may present a convenient form of cullet, or it is conveyed into a pot, heated by the waste heat of the furnace, and, when fine, used by the workman without having been allowed to cool. In this case two pots should be adapted to the furnace, communicating with two openings, which may be stopped at pleasure, so that one pot of glass may be fining while the other is being filled. When the product is a sulphuret or alkali, it is simply allowed to run into any convenient box or mould of iron.

The advantage resulting from the use of this furnace in glass-making consists chiefly in its affording the means of producing a melted silicate or glass from the raw materials, at a small expense for fuel and labor, and without introducing alkaline carbonates or sulphates into the glass-house pot; and this is of considerable importance, as it is well-known that the wear of the pots is chiefly caused by the corrosive action of the alkaline carbonate or sulphate; and, further, glass-makers, who are at present obliged to use carbonates as their source of alkaline base, are hereby enabled to use sulphates, which are considerably cheaper.

The invention relates, in the fourth place, to a process for preparing silicate of soda, by acting on a mixture of sand and salt with sulphurous acid and air, assisted by heat and carbonaceous matter, and to the preparing of sulphate of soda, in a fit state for making glass or alkali, by acting upon salt, with or without sand, with air and sulphurous acid gas, aided by heat. One of the principal advantages which this process possesses is the facility which it presents for the application of sulphurous acid, when so mixed with air, carbonic acid, and other gases, as to be unfit for conversion into sulphuric acid in the leaden chamber by the usual process: thus the sulphurous acid disengaged in the production of a glass or silicate from a sulphate, in an open furnace, and that disengaged in the roasting of metallic sulphurets previous to the ore being smelted, may be advantageously rendered available. When the sulphurous acid from these otherwise waste sources is thus applied, additional heat may not be necessary, as the gaseous products of combustion may contain sufficient; but when the sulphurous acid is obtained by burning sulphur or pyrites, additional heat must be supplied.

In conducting this operation, three parts of sand are mixed with one part of salt, and the mixture damped, so that it will cohere on being dried. The damp mixture is then spread on a drying table, in a layer about one inch thick; and, when dry, it is broken into pieces of moderate size. These lumps are placed in an upright flue or kiln, of any convenient dimensions, having an aperture at or near the top, to introduce the material, and another at the bottom, to remove it. The top of the flue is connected with a chimney or other source of draft, and at or near the bottom the sulphurous acid and hot air are allowed to enter.

The conversion of salt into sulphate of soda takes place at a low red heat; but the temperature may be advantageously raised above this point. When the lowest lumps in the kiln or flue are free from salt or nearly so (it is desirable to leave about five per cent.), they are removed, and fresh lumps are introduced at the upper aperture: thus the process is rendered continuous. When the result required is a silicate of soda, the firing and the admission of air must be so regulated that the gaseous products shall be alternately oxidizing from the presence of excess of air, and deoxidizing from the presence of unburnt carbon. In this case sulphate is produced during the first period, and decomposed and converted into silicate during the second period. When it is not desirable to produce a silicate at once, but a mixture of sand and sulphate, to be afterwards converted into silicate or glass, or else lixiviated, with the object of using the sulphate of soda in alkali-making, the firing and admission of air should be so managed as to ensure the constant presence of air in excess.

The presence of sand is not essential to the conversion of salt into sulphate of soda by the action of sulphurous acid and air; it may be replaced by a silicate, or by sulphate of barytes; or the salt may be converted into vapour by heat, and brought in that state into contact with sulphurous acid and air; or the salt may be introduced in porous lumps, formed by the conglomeration of small crystals; but the patentees prefer to mix it with some inert substance, because that enables them to raise the salt to the temperature at which it melts, without danger of the lumps losing their porosity. They are aware that a patent has been granted for effecting the conversion of salt into sulphate of soda, for the purposes of alkali-making, by exposing a mixture of salt and oxide of iron to the action of sulphurous acid and air; but they do not intend to use oxide of iron, having ascertained that the presence of an additional chemical agent is not necessary to enable sulphurous acid and air to decompose common salt.

These improvements relate, lastly, to the recovery or economy of the alkali or carbonate of soda, which is produced during the decomposition of sulphate of soda with small coal, as in the process for making sulphuret of sodium before described.

When the process of making sulphuret of sodium is well conducted, the result is free from sulphate, but contains carbonate of soda in considerable quantity; and, an application being found for the sulphuret of sodium, there is considerable economy in conducting this process to produce carbonate of soda,—the lime and much of the labor in the black-ash operation of the ordinary process being dispensed with.

In order to obtain carbonate of soda sufficiently pure for ordinary purposes, the mixture of sulphuret and carbonate of soda is received, as it falls from the furnace, in a convenient iron vessel; when nearly cold, it is dissolved in water, with or without the aid of heat; and it is then allowed to stand, and the clear strong solution is drawn off. The residue of insoluble matter is very small, being little more than the ash from the coal and a small excess of carbon: this is washed, and the weak liquor coming therefrom is used to dissolve fresh portions of sulphuret, and produce more strong liquor. The strong liquor is conveyed into an ordinary cast-iron "salting-down pan," placed over the fire, and "boiled down" as long as any deposit takes place;—the alkali which falls being "fished out" in the usual way and set to drain. This operation is rendered easy of execution by the presence of the sulphuret, which prevents the carbonate from adhering to the pan, and may be continued until little or no carbonate remains in the liquor. After being drained, the carbonate is washed once with some of the clear sulphuret liquor which has not been concentrated; and it is then dried in an ordinary "finishing furnace." When the sulphuret of sodium exceeds the quantity in demand, it may be partially oxidized by exposure to air, and used, without additional sulphate of soda, in glass and silicate making.

The patentees claim, First,—the preparation of silicate of soda, silicate of potash, and silicate of barytes, and the double silicates of these bases, by heating their respective sulphates with sand and carbonaceous matter. Secondly,—the use of a sulphuret or hyposulphite in the place of carbonaceous matter in making silicates, and in the place of charcoal, as heretofore used in making glass by means of a sulphate. Thirdly,—the use in glass and alkali-making of a furnace of the peculiar construction above described, whereby the removal, without labor, of each portion of the material from the sphere of action is effected, as soon as the heat has caused the requisite decomposition and combination,—the product being caused to flow by its own weight either altogether out of the furnace or into an attached reservoir or pot. Fourthly,—the preparation of a silicate of soda, by exposing a heated mixture of sand and common salt, first to the action of air and sulphurous acid, and afterwards to carbonaceous matter or other deoxidizing agent; and also the preparation of sulphate of soda in a fit state for glass or alkali-making, by exposing salt, or a mixture of salt with sand or other inert substance, to the united action of heat, air, and sulphurous acid. Fifthly,—the separation of carbonate of soda from the mixture of carbonate of soda and sulphuret of sodium, produced during the decomposition of sulphate of soda by carbonaceous matter.—[*Inrolled September,* 1849.]

To ANDREW PANTON HALLIDAY, *of Manchester, in the county of Lancaster, manufacturing chemist, for certain improvements in the manufacture of pyroligneous acid.*—[Sealed 28th September, 1848.]

THESE improvements in the manufacture of pyroligneous acid relate, first, to the method of manufacture; and, secondly, to the machinery or apparatus to be employed in such manufacture. In the ordinary process of manufacturing pyroligneous acid, branches or billets of oak or any other wood are introduced into air-tight cast-iron cylinders, and subjected to destructive distillation, by the application of heat to the containing surface or the surface with which the wood is in contact, and also, in some cases, by the use of steam, of high temperature, applied or introduced amongst the substances from which the pyroligneous acid and other products are to be obtained. It is also known that sawdust, wood-turnings, wood-chips, spent dye-woods, spent-tan, turf, and other vegetable substances, are capable of yielding pyroligneous acid; but, owing to the minutely divided state in which these substances exist, the ordinary method of effecting their destructive distillation becomes difficult, if not impossible, in consequence of that portion in immediate contact with the retort becoming completely charred, whilst the non-conducting property of the charcoal prevents the heat from penetrating into the interior.

The first part of this invention consists in effecting the destructive distillation of sawdust, wood-turnings, wood-chips, spent dye-woods, spent-tan, turf, and other vegetable substances of a similar character, in order to obtain pyroligneous acid therefrom, by causing such substances to pass in continuous motion through heated iron tubes, pipes, or retorts, by means of suitable machinery or apparatus. The sawdust, wood-turnings, wood-chips, spent dye-woods, spent-tan, turf, or other vegetable substances, from which the pyroligneous acid is to be distilled, are introduced into a hopper, in which vertical screws or worms revolve, conveying the material (regulating, at the same time, the supply) to the retorts, placed in a horizontal position, and heated by means of a furnace; and, in which retorts, revolving screws or worms keep the material in constant agitation, moving it, at the same time, forward, until the whole is completely carbonized and all the pyroligneous acid evolved. The charcoal, thus formed, falls through pipes dipping into a vessel of water, or into an air-tight vessel, from which a pipe dips into water, to allow the gas to escape as the vessel fills with charcoal; and from which the latter may be withdrawn through a door at the side. The pyroligneous acid is condensed, in the usual way, in pipes of iron or copper, surrounded with or immersed in water,—the other products obtained by the destructive distillation of the material being employed in the ordinary manner.

In Plate XII., fig. 1, is a front elevation of the apparatus employed in carrying out this invention; fig. 2, is a back view of the same; and fig. 3, is a vertical section, taken longitudinally through about the middle of the apparatus. *a*, represents the hopper, in which the sawdust or other material is placed; *b*, *b*, are vertical feed-pipes, in which the worms or screws *c*, *c*, revolve; *d*, *d*, are the retorts, placed horizontally, and containing the revolving screws *e*, *e*; *f*, *f*, are the condensing pipes, from which the pyroligneous acid passes, in vapour, to the main *g*; *h*, is a pipe, through which the vapour is conveyed to the condenser; and *i*, *i*, are pipes, down which the charcoal falls into the vessel *k*, containing water. The vertical screws *c*, *c*, are caused to revolve in the following manner:—At the upper extremity of the vertical spindles *l*, *l*, (to which the screws *c*, *c*, are attached) bevil-wheels *m*, *m*, are keyed, gearing into bevil-pinions *n*, *n*, upon the horizontal shaft *o*; at one end of which is a spur-wheel *p*, in gear with a similar wheel *q*, upon one end of the transverse shaft *r*; and, at the other end of this shaft *r*, is keyed a worm-wheel *s*, receiving motion from a worm *t*, keyed upon the vertical driving-shaft *u*, which may be connected to the steam-engine or other motive power in any convenient manner. The horizontal screws *e*, *e*, are caused to revolve by the following means:—Upon the ends of the spindles *v*, *v*, (to which the screws *e*, *e*, are attached) worm-wheels *w*, *w*, are keyed, gearing into worms *x*, *x*, upon the horizontal shaft *y*, *y*, to which rotary motion is imparted from the vertical driving-shaft *u*, by means of the mitre-wheels *z*, *z*. The retorts *d*, *d*, are heated by means of a furnace 1.

The operation of the apparatus is as follows:—The furnace 1, in which the retorts are placed, being heated to the required intensity, and the hopper *a*, filled with sawdust, wood-turnings, wood-chips, spent dye-woods, spent-tan, turf, or other similar vegetable substance, the machinery is to be set in motion; and the material will then be carried down the feed-pipes *b*, *b*, by means of the screws *c*, *c*, to the retorts *d*, *d*, along which it will be caused to advance in a continual state of agitation by means of the screws *e*, *e*. In its passage through the retorts the material becomes perfectly carbonized, and the vapour evolved passes up the pipes *f*, *f*, to the main *g*, whence it passes off through the pipe *h*, to the condenser. The charcoal formed in the process falls down the pipes *i*, *i*, into the vessel *k*.

This invention also consists in effecting the destructive distillation of billets or branches of wood, sawdust, wood-turnings, wood-chips, spent dye-woods, spent-tan, turf, or other similar vegetable substances, in order to obtain pyroligneous acid therefrom, by forcing a current of hot air through the same. The temperature of the air may be ascertained by means of a pyrometer or thermometer previous to its entrance into the vessel containing the wood, and may easily be regulated to the heat required. The apparatus found to answer best for this purpose consists of a double cylinder; the outer one being constructed either of cast-iron or fire-bricks; and a space of about one or two inches being left between them, all around, to allow of the free circulation of the heated air. The inner cylinder is constructed of strong wires, if billets or branches of wood are used; or of sheet-iron perforated, or wire gauze, if any of the other above-mentioned materials are employed. It is preferred to place the cylinder in an upright position,—the heated air entering at the bottom of the outer cylinder, and escaping, with the vapours of pyroligneous acid, through a pipe near the top and at the side of the outer cylinder into the condenser, to be condensed in the usual manner. The heated air is supplied by pipes and forced, by means of fans or other known apparatus, through the materials to be subjected to destructive distillation.

The patentee claims, Firstly,—manufacturing pyroligneous acid from sawdust, wood-turnings, wood-chips, spent dye-woods, spent-tan, turf, or similar ligneous vegetable substances, by causing such substances to pass in continuous motion through heated iron or other tubes or retorts. Secondly,—manufacturing pyroligneous acid by the application, employment, or use of the machinery or apparatus shewn and described for effecting the above object. Thirdly,—manufacturing pyroligneous acid by forcing a current of heated air through branches or billets of wood, sawdust, wood-turnings, wood-chips, spent dye-woods, spent-tan, turf, or similar ligneous vegetable substances.—[*Inrolled March,* 1849.]

To THOMAS DICKINS, *of Middleton, in the county of Lancaster, silk manufacturer and printer, for his invention of certain improvements in machinery or apparatus for warping and beaming yarns or threads, composed of silk or other fibrous materials.*—[Sealed 21st December, 1848.]

THESE improvements apply principally to the warping and beaming of yarns or threads composed of silk, and are designed for the purpose of preserving, as much as possible, equality of tension and equality of length throughout the whole warp; at the same time affording greater facility for taking the "cross" or "lease" (as it is termed), and for maintaining the threads, as nearly as possible, in their proper relative situations; and also allowing of the yarn being wound on to a hollow beam or "shell" direct from the mill, without being balled or wound on to a drum; by which means, as the threads are not disturbed between the operations of warping and beaming, the liability of their being twisted or entangled will be avoided, and a more perfect and even warp than that hitherto produced will be obtained.

In Plate XI., fig. 1, represents, in plan or horizontal view, the improved warping-mill and creel; and fig. 2, shews the same in side elevation. *a, a,* is the creel, containing the bobbins of silk or other fibrous materials; *b, b,* are two glass rods, between which the threads pass; *c c,* is the lease or cross-reed, the peculiar construction of which is shewn, in front view, at fig. 3; *d, d,* and *e, e,* are horizontal guide-rods; *f, f,* are vertical guides or wires; *g, g,* is the reel or mill, supported in suitable bearings, with its axis in a horizontal position; *h,* is a shaft, passing through its centre, and furnished with a screw or worm *i, i,* working in a nut *k, k*; and *l,* is a handle on the end of the shaft *h,* for turning the mill *g, g,*—or power may be applied if convenient.

The operation of warping, by means of this apparatus, is as follows:—The attendant having first removed the upper glass rod *b*, takes each thread separately, and in regular succession, beginning at the first, and, with an ordinary reed-hook, draws them through the lease-reed *c*, *c*, passing the first thread through the slot in the dent (see fig. 3,) and the second through the space between the dents, and so on alternately to the end,—tying up the threads from each row of bobbins (or from as many as are desired to form a small division of the warp) as the threads are drawn in. Having replaced the glass rod *b*, above the threads, he next takes each knot or small division of the warp-threads, and passes them between the guide-rods *d*, and *e*,—placing each of these small divisions separately in one of the spaces between the vertical guides *f*, *f*, and passing the knots around the peg *m*. The lease or cross is then taken in the following manner:—The lease-reed *c*, *c*, is raised by means of the cord *n*, (see the sectional view, fig. 4,) and kept in that position by placing the ring at the end of the cord upon one of the pins *o*. This will have the effect of raising every thread that passes through the slots in the dents of the reed,—that is to say, each alternate thread. Into the shed or opening in the threads thus formed, the warper introduces a thin slip of wood; he then lowers the lease-reed *c*, and thereby depresses all the threads which were before raised, and crosses each alternate thread. In this second shed or opening he places another slip of wood; and he next passes these slips forward, preserving the lease or cross until he is enabled to place one series of threads over the pin or peg *p*, and the other over the peg *q*, as represented at fig. 2. He then turns the mill *g*, round in the direction of the arrow, fig. 2, by means of the handle *l*; and the screw *i*, working in the nut *k*, will cause the mill *g*, as it revolves, to traverse in the direction of the arrow, fig. 1.;—thus winding the yarn on in a spiral direction across towards the other side of the mill, until the desired length has been warped out. The patentee remarks, that the same end may be attained by causing the creel, lease-reed, and guides, to traverse whilst the mill only revolves. The warper then crosses each knot or smaller division of the threads, and, placing one series of knots or divisions over the peg *r*, and the other over the peg *s*, passes the whole around the peg *t*; and, having again taken the lease or cross of the said divisions or knots of threads, he commences turning the mill in the opposite direction, coiling another series of threads on to the mill above the former, until he has reached the point from whence he first started. He then (in the manner above described) takes the lease or cross of each thread, and, after passing the whole around the peg *m*, takes the lease or cross of each thread again, and commences winding on another coil, and so on until there are a sufficient number of threads wound on to the mill to form an entire warp. Having taken the lease or cross of the last coil of threads, he severs them, ties them together, and places the knot or knots upon the peg *m*. He then, at each end of the warp, places bands or cords through the entire lease or cross formed upon the pegs, and ties them up;—thus preserving, in due order, the lease of the alternate threads at the commencement, and likewise the lease of the alternate knots or small divisions at the end of the warp as they were respectively formed upon the pegs. He next ties up each knot or division of the warp between the reed *c*, and the mill, ready to commence a fresh warp. The entire warp, thus formed, may then be wound off in the usual manner, or on to a cylinder or beam; or it may be wound on to a shell in the following manner:—The threads having all been severed or disconnected from the warping apparatus, the mill must be turned partly round, and the threads passed under the guide-rollers *u*, and each separate layer or coil of the warp, taken in order as warped, placed in one of the spaces between the upright wires or guides *v*, *v*, that is to say, as many threads are passed between each guide as there are bobbins on the creel. They are then passed under the roller *w*, and upwards over a roller *x*, (to allow of their spreading or opening out previous to their being passed through an ordinary "raith" or "ravel,") and wound on to the shell in the usual manner. The yarn being thus on, may be taken to the loom, where the weaver passes a spindle through the centre of the shell, and fastens it with wedges or otherwise in the position required. It will be obvious that, with the above-described method of warping, especially for light warps, such as silks, muslins, &c., as the warp-threads run in a direct line from the bobbins to the guides *f*, *f*, (see fig. 1,) there will be a considerably less amount of friction than in the ordinary process (particularly where the "heck" is employed, and where the angle, at which the threads run, is constantly varying), and, consequently, less breakage of the threads will occur, and the threads will be less liable to get twisted or entangled. Another great advantage (particularly when the warp is required for weaving stripes) is, that a much greater number of bobbins can conveniently be used, and thus a great amount of time and trouble will be saved. The tension and length of the warp is likewise kept much more regular than by the system hitherto in use, and a much greater facility is afforded to the weaver by reason of the threads being kept parallel.

The patentee claims, Firstly,—with respect to the warping apparatus, the general novel construction and arrangement of the apparatus, and more particularly the peculiar formation and application of the lease-reed *c*, employed or used for taking the lease or cross, and the method of traversing the mill when used in the horizontal position, as described; or, instead thereof, he claims traversing the creel, lease-reed, and guide-rods laterally, to effect the same purpose; and, Secondly,—with regard to the beaming of warps, he claims the method of winding the yarn on to the beam direct from the mill, without removing it upon a drum, or in the form of a ball, as hitherto practised.—[*Inrolled June,* 1849.]

To Pierre Armand Le Comte de Fontainemoreau, *of Skinners-place, Sise-lane, in the City of London, for certain improvements in the process of, and in the apparatus for, treating fatty bodies; and in the application of the products thereof to various useful purposes,—being a communication.*—[Sealed 25th November, 1848.]

This invention is stated by the patentee to consist, firstly, in improvements in the process and apparatus for treating fatty bodies in general; and, secondly, in the application of the several products obtained by the said improved process and apparatus to the manufacturing of candles and other similar luminaries, and also to various other useful purposes.

He observes that his process and apparatus for treating fatty bodies are in part founded on principles either known or already patented, namely, the operations for the acidification, distilling, and solidification of the said fatty substances; and he therefore confines his claim to the modes of carrying these principles into operation, and to the operations themselves.

Acidification of fatty bodies.—The fatty bodies, having glycerine for their base, are introduced into a sheet or cast-iron vessel, set upon a furnace; or else the patentee makes use of an iron vessel, within which the enamelled copper containing the fatty bodies is placed, and heated, as in a *balneum mariæ*, by causing steam to circulate between the two vessels, or by means of a bath of molten metal, or by a solution of caustic alkali, or of saline substances, or any fatty body, the temperature of which is maintained at a very high degree.

The patentee states that he also uses granite or wooden troughs, thickly lined with lead, and heated internally by worms, through which steam circulates, or by any other convenient means hereinbefore described. The time required for the process of acidification, and the quantity of acid necessary, depend on the nature of the fatty body. When the acidification is complete, the deposit formed by the substances operated upon is separated, and the fatty acids are washed with boiling water. After some rest, the fatty acids separate from the water; and they are subjected afterwards to the following process of distillation.

Improvements in the process of treating vegetable tallow:—The *first process* relates to vegetable tallow, but can also be applied to animal tallow. The patentee employs a leaden vessel, or an enamelled metal boiler, which is heated by any convenient means; or he uses a wooden vat, which is heated, by the injection of steam, to from 316° to 352°. Before injecting the steam, the substance must be heated to 212°; the fatty animal or vegetable substance is poured into the vessel with a quantity of water, equal to a third of its volume; and then an addition is made of slacked lime, in the proportion of about three ounces of lime to 222 lbs. of greasy substance. The mixture is well beaten together, while it is kept at a boiling temperature, for 15 or 20 minutes; and then the lime is neutralized with common azotic acid, which must be added in excess; so that after the lime has been neutralized, there will remain about 16 ounces of acid for each 220 lbs. of grease in the boiler. After the mixture has boiled for three quarters of an hour, or thereabouts, the patentee takes care to replace what has escaped in the form of vapour, by adding boiling water every 20 minutes, until the operation is completed; and which is not to last more than two hours. When the tallow is found sufficiently bleached and hard, he pours suddenly into the boiler about six quarts of cold water to every hundred-weight of greasy substance,—taking care, at the same time, to stop the fire. After this, the grease is allowed to deposit during one or two hours; and it is then fit for being made into candles.

The above-described process may be modified and usefully employed for treating a material known by the name of vegetable wax, as follows:—Two hundred-weights of vegetable wax are melted with about a quart of water; then into the boiler about 2¼ lbs. of an alkaline azotate (for instance, that of soda) are poured; after which, the solution is caused to boil; and then some concentrated sulphuric acid is added in small quantities, until the azotate is decomposed,—care being taken that the sulphuric acid is slightly in excess. During this operation a certain quantity of azotic or hypoazotic acid is disengaged; and when reddish vapours appear and become more and more abundant, as the boiling is continued, the operator will know that very little water remains in the boiler; he must then gradually pour in some water, until the vapours assume a whitish color; and, after this, some more sulphuric acid is to be added. When the reddish vapours reappear, they are to be instantly stopped by pouring in water; and this mode of operating is to be continued until the substance seems to be sufficiently white and purified;—at this moment the operation is stopped by adding an excess of water at 140°; and the fire is put out. The wax, thus prepared, is well stirred up with its volume of warm water, to purify it completely. The patentee remarks, that azotic acid alone may be used in the above operation in place of the sulphuric acid and alkaline azotate.

Second process for treating vegetable wax and tallow.—If the substance is not sufficiently bleached by the above operation, the patentee subjects it to the action of chlorine combined with oxygen in the state of an alkaline hypochlorite, as follows:—The matter is to be melted and the liquid gradually added,—taking care to agitate constantly. The whole forms a paste, which soon acquires a very white appearance, if the operation has been properly attended to, and a sufficiently concentrated liquid has been employed: about one pint and a half of hypochlorite suffices for about 2 lbs. of fatty substances. When the paste has attained the desired whiteness, a sufficient quantity of sulphuric acid is added to neutralize the alkali; after this, the fatty matter is well washed with water; and the matter is then clarified by being melted in the boiler where the bleaching and purification have taken place; but it is always necessary to add a small quantity of sulphuric acid. By mixing the brittle vegetable wax, known by the name of "carnanba wax," with about an equal weight of a suitable fatty substance, and by operating as hereinbefore stated, a product, very similar to bees' wax, and capable of being applied to various useful purposes, is obtained. The fatty bodies, having been acidified, as hereinbefore stated, are afterwards to be distilled; and this the patentee effects by the modes described below.

Firstly,—distillation of the fatty bodies.—That which is obtained under the influence of a current of steam, the pressure of which must not exceed half an atmosphere before receiving a higher degree of heat: the patentee operates with that current of steam alone or in conjunction with a vacuum. The worm, through which the steam passes to be heated, before being brought to act upon the fatty body, may be raised to nearly a red heat, and can be made of metal or of plastic substances. The patentee also proposes to cause a current of steam to run through a red hot pipe, containing charcoal or coke, wherein the steam, being entirely or partly decomposed, forms hydrogen gas and oxide of carbon, which are to be employed as the heating medium in the distilling operation. He likewise produces steam, heated to the proper degree, by injecting steam, obtained from the generator, into a bath of molten metal, or by causing the steam to run through tubes immersed in the said bath. The steam, either alone or mixed with the gases produced as hereinbefore stated, descends to the bottom of the distilling apparatus through a pipe, provided with a rose-head, or through a worm, perforated with small holes; and, besides this means of heating, there is a fire under the distilling apparatus. The vapours produced by the water and grease flow from the apparatus into a small recipient, where these vapours are partially condensed during their passage; while the substances not volatilized, but projected by the action of the distillation, are also deposited in the said recipient; and, finally, the whole is taken away. From the small recipient the vapours pass into a large condenser, which must be made of enamelled metal, or of substances not liable to be injuriously acted upon by acids. These condensers are in communication with the receivers, from which the substances can freely flow or be thrown out by means of a drawing or forcing pump. When the apparatus is subjected to the vacuum, the patentee causes the extremity of the pipe (which descends from the condenser) to plunge into the liquid contained in the recipient; and, by that contrivance, the matters are prevented from being disturbed in that receiver: this precaution causes the bodies, in a state of suspension, to separate in the receiver without requiring filtration. The steam, vapours, and grease, not yet condensed, escape through an eduction-pipe, situated above the tube that connects the condenser with the recipient.

Secondly,—the mode of distillation by intermittent continuity.—In Plate X., fig. 1, is a longitudinal section, and fig. 2, a transverse section of the apparatus employed. A, is a boiler, formed of copper, or other metal not injuriously acted on by fatty acids, and containing the matters to be distilled; and B, is an open cast or sheet-iron vessel, heated by a furnace, and containing molten metal,—by means of which, heat is communicated to the vessel A. As the distillation of greasy acids takes place at the point of fusion of lead, the patentee forms the bath of this metal; and he states that it will be sufficient, in order to secure a regular distillation, to maintain the lead-bath constantly in a state of fusion in that part situate above the furnace, and to keep it in a state of paste at the other extremity. The boiler is kept about one-third full of fatty matter, which is supplied to it, in a fluid state, through the bent tube E; and the products of distillation pass from the head F, to an ordinary condensing apparatus. The boiler A, is provided with the discharge-pipe C, fixed at the extremity opposite to the part which is placed immediately above the furnace; and there is a steam-pipe D, extending along the bottom of the boiler A, and having perforations or slots formed in it at intervals, through which the steam escapes, and urges the products of distillation from the boiler into the condenser. As the distillation proceeds, the boiler is supplied with more liquid fatty matter at suitable intervals; but when the residuum accumulates in the boiler A, to such an extent as to interfere with the distillation, the supply of fatty matter is stopped, and the distillation is continued until the volatile parts of the sediment have been removed. The residuum is then removed from the boiler by opening the cock on the discharge-pipe C; and the discharge of the residuum may be facilitated by shutting the cocks of the tube E, and of the pipe through which the products of distillation escape from the head F,—when the steam, being thus confined within the boiler A, will drive the sediment out through the pipe C. All this is done without stopping the fire; and the operation of distilling a fresh supply of fatty matter is then proceeded with as before.

Thirdly,—the mode of distilling intermittently and continuously, applicable to fatty bodies and other similar substances.—Fig. 3, represents a sectional elevation of the apparatus employed. A, A, are tubes, provided each with a valve opening internally. B, B^1, are man-holes, having each a weighted valve B^2, B^3, opening externally, and situated within a thin vertical pipe, through which the vapours escape into the atmosphere. C, C^1, are stills of a spherical form; D, is a pipe, for introducing steam into the first still C; and D^1, is the neck of the still C, connected with a pipe for introducing the fatty acids and aqueous vapours into the still C^1. E, E^1, are rose-heads, which serve to divide the vapours and fatty acids; F, F, F, are perforated partitions, placed in both the stills C, and C^1, in order to compel the vapours and fatty acids to traverse as much space as possible; and G, G^1, are perforated discs, which are intended to stop the scum. H, is a small vessel, connected with the still C^1, by the pipe G^2, and is designed to receive the substances carried by the vapours from the still: it is divided by a partition, which serves to separate the products, and is connected by the neck H^1, with the worm, contained in the vat or vessel I, I^1. This vessel is composed of two parts, separated in the middle by a partition J; the upper part I, contains the fatty bodies, which flow through the pipe O, into the second still C^1; and the lower part I^1, contains the water, which is introduced by the feeding-pipe Q, and flows out through the eduction-pipe R. K, is the receiver of the condensed liquids; L, is a pipe, connecting the receiver K, with the tubular column M, through which the uncondensed products are caused to ascend: it is provided with several partitions, and is supplied with a jet of water by the pipe M^1. N, is a tube, connecting together the two stills C, and C^1, and serving to feed the first. P, is a tube with a funnel-shaped top, through which the fatty matters are introduced into the upper part I, of the vat. S, is a discharge-pipe, set in the still C^1, for the expulsion of the residuum; T, is a discharge-pipe for the water in the tubular column M; and X, X^1, are discharge-pipes for the products condensed in the receiver H.

The distillation of the fatty matters is conducted as follows: The fatty matters, in a liquid state, are introduced into the vessel I, by means of the feeding-pipe P; the fatty bodies being heated, as hereinafter described, flow from the part I, of the vat, through the pipe O, into the second still C^1; and from the latter they are conducted into the first still C, through the connecting-pipe N. The two stills C, and C^1, being heated by fire in the manner already described, when speaking of the previous apparatus for distilling, and the fatty substances having reached about 212 degrees of heat, steam is introduced by means of the pipe D, through the holes in the rose-head E, into the still C. The vapours produced in C, are introduced by the pipe D^1, into the bottom of the second still C^1, through the holes in the second rose-head E^1. From the still C^1, the vapours pass through the connecting-tube G^2, into the receiver H, and from thence they reach the worm through the pipe H^1. The aqueous and fatty vapours, while condensing in the worm at the upper part I, of the vat, heat the fatty bodies which have been introduced into that chamber by the feeding-pipe P; the products condensed at the lower part of the worm in I^1, fall into the receiver K; the water runs out by the eduction-cock T; and the distilled fatty body is taken out through the cock U. The non-condensed vapours ascend through the connecting-pipe L, into the tubular column M, where they are condensed by the jet of water from the tube M^1, and drawn off through the pipe V. When, after several distilling operations, a rather large quantity of matters, which cannot volatilize, remains in the still C, the same must be expelled through the discharge-pipe s, by the pressure of the steam, which is increased by shutting the cocks of the pipes N, and O.

The products obtained by the above-described modes of distillation, and which are but little colored, are clarified before and after being pressed; and then these products are cast as usual into candle moulds. For these clarifying operations the patentee employs troughs similar to those hereinbefore described, when speaking of the acidification of the fatty bodies. When palm oil is subjected to the process of acidification and distillation hereinbefore mentioned, products are obtained from them sufficiently firm to be cast into candle-moulds, without their requiring the pressing operation. The patentee states, that for the hot-presses he uses plain hollow plates, which he heats by means of a current of steam: he supplies the steam to these plates by adapting to each of them a tube, moving into another tube, forming a kind of stuffing-box at its top, and wherein it moves up and down; this action allows that tube to extend or collapse at will, according to the motion which the pressure transmits to the plates; each tube is in communication at the top with a steam reservoir, common to all of them; and at the lower part of each plate the steam and condensed water flow out freely.

The patentee states that he does not confine himself to the above apparatus, but modifies the same according to circumstances, or makes use of any other means capable of producing similar results. He causes the steam, heated in the manner before stated, to pass through the substances to be distilled, which may also, at the same time, be heated by a fire beneath the apparatus, or by any other suitable means. The current of steam draws with it the volatile products, which enter into a condenser, where they are in great part liquified. From the liquid, he extracts (by some mere additional distilling operations, conducted under the action of the steam, heated as hereinbefore described, or by any other convenient means, and by one or more crystallizations) the following matters:—Firstly, the matters for making candles; secondly, pyrogineous oils, serving for lighting; and, finally, some other useful products, such as gas, of a superior quality, for lighting. He introduces into the common candles, manufactured from the products obtained by the processes before described, stearine, produced from tallow and grease; and which stearine he also uses for preventing the crystallization of his fatty acids. The patentee states that the principle of the operation is based upon the crystallization of these substances being obtained by a slow cooling, and on their pressure being effected within very resisting cylinders, which may be internally provided with other cylinders, conveniently perforated. The cakes, formed by the substances operated upon as hereinbefore described, are pressed within the above cylinders, separated from each other by means of close fabrics. He bleaches and disinfects the grease and stearine by using potash or soda in the state of a very concentrated solution, which he adds to the melted substances in the proportion of some hundredth parts of the weight of the said grease and stearine;—he separates the deposit which is formed by the agency of the above-mentioned solution; then he operates on the substances by using proportionably to their weight half of a hundreth part of chlorate of potash, which is dissolved in forty parts of water, and to which one part of sulphuric acid is added; and he causes the whole to boil, during about half an hour, to complete the operation. The same mode of operating can be applied to the preparation of vegetable tallow. He manufactures candles, having externally a very fine yellow color, and being at the same time very diaphanous, by maintaining, during at least one hour, at a temperature of about 420°, the most crystallizable acid, prepared as hereinbefore stated, until it has acquired a yellowish color; he then casts it in the moulds, taking care that the temperature of the melted substance should be at about 176°; and he suddenly cools the moulds, by subjecting them to a strong current of water, or by means of ice, or by any other suitable means, producing a sudden depression of temperature. To solidify the oleic acid or the oleine it is introduced into an iron vessel (which is internally coated with enamel, and so constructed that it can resist a powerful pressure), and hypoazotic or hypochloric acid, or any other gas answering the same purpose (namely, the solidification) is added; the contents of the vessel are then subjected to a very strong pressure by any of the means usually employed; and the substance is afterwards washed and distilled as hereinbefore described.

The patentee here remarks, that he uses enamelled surfaces for all the apparatus hereinbefore described; and when the articles which require to be enamelled are precluded, on account of their shape or volume, from being introduced into the oven generally employed for such operations, they must be enamelled in pieces, and afterwards united by small screws or otherwise. He uses a powerful jet of lighted gas, passing through a blow-pipe, for fixing the enamel, reduced to powder or paste, upon the uncovered parts. The enamel, thus melted, can also be applied for enamelling large metallic sheets or plates, and also for repairing injuries in the enamelled apparatus herein employed.

In conclusion, the patentee states that, as the refuse matters, resulting from the above distilling operations, have very often the elasticity of India-rubber, they may, by combining them with asphalte, be made to serve as a substitute for natural bitumen; they may also be used for the production of typographical ink, cloth-varnish, and gas for lighting; and, by subjecting them, either alone or combined in suitable proportions with lime, to a slow distilling operation, an oil, fit for dissolving India-rubber, and for lighting, may be produced.

The patentee claims, Firstly,—the general *modus operandi* and combination of the several operations for the acidification, distillation, and solidification of fatty bodies, and of the apparatus therein employed. Secondly,—the use of troughs, either made of granite or enamelled metal, as hereinbefore described. Thirdly,—the use of earthy substances and enamelled metal in the construction of worms and other condensers, serving to heat the steam to a higher degree of temperature. Fourthly,—the mode of producing steam, heated to a higher degree of temperature, and gases, for the distillation of fatty bodies. Fifthly,—the bleaching, disinfecting, and solidifying of vegetable-tallow by means of azotic acids and oxygen, either alone or combined, assisted by other chemical agents; and also the use of chlorate of potash, as hereinbefore described. Sixthly,—the treating of vegetable wax with the combination of azote and oxygen, when they are disengaged, to form alkaline azote; and also the combination of chlorate of oxygen. Seventhly,—the use of steam, heated to a higher degree of temperature, to avoid the condensation of the water, which may be produced by the injection of steam, in its natural state, in the operations for heating vegetable wax and tallow, as hereinbefore described. Eighthly,—the treating of carnanba wax, as hereinbefore described. Ninthly,—the distilling apparatus, by which the operation is made intermittent and continuous; and the mode of heating, as before described. Tenthly,—the combination of two stills, for distilling; and the mode of making these operations continuous and intermittent, as hereinbefore described. Eleventhly,—the means by which the filtering operations of the substances are dispensed with. Twelfthly,—the clarifying of the fatty acids before being pressed. Thirteenthly,—the various processes for treating oleine and stearine, as hereinbefore described. Fourteenthly,—the process for obtaining the solidification of the oleic acid or oleine, as hereinbefore described. Fifteenthly,—the manufacture of yellow transparent candles, as hereinbefore described. Sixteenthly,—the mode of heating presses, by causing a current of steam to be run into the hollow metal sheets; and the application thereof to the heating of fatty bodies. Seventeenthly,—the mode of treating and employing the refuse substances, obtained from the distillation of fatty bodies, for the production of typographic ink and other useful purposes. Eighteenthly,—the application of an enamel to all apparatus employed, as hereinbefore described, for the heating of fatty bodies.—[*Inrolled May,* 1849.]

To WILLIAM EDWARD NEWTON, *of the Office for Patents,* 66, *Chancery-lane, in the county of Middlesex, civil engineer, for certain improvements in steam-engines,—being a communication from Charles M. Keller, Esq., of New York.*—[Sealed 28th December, 1848.]

THIS invention of improvements in steam-engines is represented in several views in Plate X. Fig. 1, is a vertical section of a steam-engine of the improved construction, taken in a plane parallel with the beams, and passing through one of the cylinders and the crank-shaft; and fig. 2, is another vertical section, taken at the line A, *a,* of fig. 1. Figs. 3, and 4, are diagrams of the ordinary crank-beam engine, to illustrate the irregular mechanical force on the crank of a steam-engine working expansively. Fig. 5, is a longitudinal vertical section of an improved condensing apparatus; fig. 6, is a section thereof, taken at the line B, *b,* of fig. 5; and fig. 7, is a cross section of the pumping part of the apparatus, with the auxiliary engine, by which it is operated.

The inventor, preparatory to explaining the nature of his invention, makes the following introductory remarks:—It is a well-known fact, in the application of steam as a motive power, that the more the principle of expansion is introduced the more economical will be the effect produced, provided some element or elements be not introduced in the mechanism to counteract it. To give the full effect to this expansive principle of steam, it should be either applied to a resistance which decreases in the exact ratio of the decreasing pressure of the steam, by reason of its expansion or dilatation, or, what amounts to the same thing, the leverage of the body, impelled by this force, should increase in the inverse ratio of the decreasing pressure. The ordinary crank-engine, in general use, presents, in nearly every particular, the reverse of the requirements of this problem; and it would be difficult to conceive a mechanism theoretically so ill adapted to the application of this principle; but still, from its practical advantages in other particulars, it continues in use, because of the practical objections to all other plans which have been suggested for overcoming its theoretical defects. The irregular mechanical force of steam, applied expansively to the ordinary crank-beam engine, is illustrated in diagrams 3, and 4,—the former being based on the assumption that the steam is cut off at one-quarter of the stroke, and the latter at one-twentieth. In these diagrams *a*, represents the cylinder; *b*, the piston; *c*, the piston connecting-rod; *d*, the beam; *e*, the crank connecting-rod; *f*, the crank; *g*, the circle described by the centre of the crank-pin in the rotation of the crank; and *i*, the line of pressure of the expanding steam. When the steam is cut off at one-quarter of the stroke, one-half of the whole mechanical force of the steam is expended in forcing the piston up to the dotted line *h*, a little more than one-quarter of the entire stroke,—the crank making but about one-third of its semi-rotation from the dead point, and therefore along that part of the rotation in which it presents the shortest leverage. During the next quarter of the stroke, the crank passes to the line *j*, which indicates the half of the semi-revolution; and, in passing to this point, the leverage of the crank increases nearly in the inverse ratio of the decreasing pressure of the steam on the piston; but this is the only part of the stroke in which the motion and leverage of the crank are in such relation to each other as to give an approximation to the full mechanical force of the steam; whereas, during the remaining half stroke, the leverage of the crank decreases as the pressure decreases. The great defect is to be found in the fact that (when the steam is cut off at the quarter stroke) one-half of the mechanical force of the steam is exerted in moving the crank through only one-third of the circuit due to the entire stroke,—the other two-thirds remaining to be effected by the other half of the mechanical force of the steam, and that too by a force decreasing as the leverage, to which it is applied, decreases. But it will be seen, by reference to the diagram, fig. 4, that this irregularity, so wasteful of power, increases as the steam is cut off at a less portion of the stroke,—as, for instance, in this diagram the steam is supposed to be cut off at one-twentieth of the stroke. In this, the line of mean pressure *h*, is at one-eighth of the stroke; and therefore one-half of the mechanical force of the steam has been exerted in moving the piston only one-eighth of its stroke,—the remaining seven-eighths of the stroke having to be effected by the remaining half of the mechanical force. It follows, from these illustrations, that the more expansively steam is applied to the ordinary crank-engine, the more irregular will be the motion, and the more wasteful the application of the impelling force.

In view of the problem above given, and the theoretical defects of the ordinary engine, the desideratum has been, the production of an engine which would present all the practical advantages of the ordinary crank-engine, such as simplicity and cheapness of construction, strength and durability, and which, at the same time, would admit of a more economical application of the principle of the expansion of the steam.

The accomplishment of this important end is the object of the first part of the present invention, which consists, first, in placing the axis of the crank-shaft in a plane nearer than heretofore to the axis of vibration of the beam which transfers the power from the piston to the crank; that is, instead of placing the axis of the crank-shaft in a plane midway between a plane passing through the axis of the connection of the connecting-rod with the beam at the two extremities of its vibrations, and a plane parallel to it, and passing through this point of the beam at the middle of the vibration, it is placed within this plane,—that is, in or near a straight line, passing through the axis of the connection of the connecting-rod and beam at the extremities of the vibrations of the beam; whereby less than the first half of the stroke of the piston shall carry the crank through one-half of its semi-revolution,—that is, from the dead point to the right angle; and the remaining portion of the stroke, more than one-half, shall give to the crank the remaining half of the semi-revolution,—that is, carry it from the right angle to the other dead point, and, at the same time, bring the line of the connecting-rod (which is shorter than heretofore, say a little more than double the throw of the crank), nearer to a right angle with the crank during the second half of its semi-revolution than during the first half; and thus not only increase the proportional velocity of the piston, whilst impelled by the expanding steam, but make it act on a longer lever than by any other known crank-engine. Secondly, in combining with the crank-shaft, located on the principle herein specified, two single-acting engines, acting on cranks, placed on the shaft at an angle of 180°; whereby the force of expanding steam may be more economically applied, and a more regular motion obtained, than heretofore. And, thirdly, in making the second engine of greater capacity than the first, and receiving steam at one end only and from the first;—this end being also alternately connected with the first engine, to receive steam, and with the condenser for exhausting, that the piston may be acted upon in one direction, by the expansion of steam, after it has acted in the first engine,—there being a vacuum on both sides of the piston during its return motion, when this is combined with the first engine, which receives the steam at one end only,—its other end being connected with that end of the second engine which receives the steam; so that, during the return-stroke of the piston in the first engine, it shall be balanced by the expanding steam whilst it is acting on the piston of the second engine.

In the drawings at figs. 1, and 2, *a,* and *b,* represent two beams, having the same axes of vibration, and both of the same proportions. The short arm of the one *a,* is connected by a rod *c,* with the piston-rod *d,* of a piston *e,* that works in the cylinder *f,* of the first engine; and the corresponding arm of the other beam *b,* is in like manner connected with a piston *g,* working in the cylinder *h,* of the second engine (see fig. 2,), and which is to be placed as near as practicable to the first. The long arms of the two beams are connected by rods *i, j,* with two cranks *k, l,* on the crank-shaft *m,* and opposite to each other; that is, dividing the circle into two equal parts, that one piston may be up whilst the other is down, and *vice versâ.* The connecting-rods *i, j,* should be about two and a half times the length of their cranks. The axis of the crank-shaft is in the straight line *n,* passing through the centres of the connection of the connecting-rods *i, j,* with the beams *a, b,* when at the extremity of vibration of the beams; from which position, relatively to the proportions of either one of the beams and length of crank and connecting-rod, it results, that the long arm of the beam, in being moved to the position indicated by the dotted line *p,* about one-third of its entire vibration, by one-third of the down stroke of the piston *e,* will carry the crank *k,* from the dead point to the right angle, one-half of its semi-revolution, as indicated by the dotted lines *p;* and that in passing through the remaining two-thirds of its vibration, to the position occupied in the drawings by the beam *b*, by the remaining two-thirds of the down stroke of the piston *e*, the crank *k*, will be carried the remaining half of its semi-revolution to the second dead point. The dotted lines *o*, *o*, *o*, *p*, *p*, *p*, and *q*, *q*, *q*, illustrate how much nearer to a right angle the pull of the connecting rod is on the crank during the second half of its semi-revolution than during the first half; for this directness of the pull during the second half of the semi-revolution must be greater than during the first half, in the proportion of the greater range of motion of the piston during the one than during the other,—that is, nearly in the proportion of two to one. So soon as the first piston has reached the end of its down stroke, and its crank has performed the effective half of its revolution, the second piston begins to descend, producing the same effect on its crank; and in this way the two pistons and their cranks alternate,—no force being applied to either of their pistons during their up-motion: the cranks, therefore, each pass through the remaining half of their revolutions without any impelling force being applied to them. Steam is admitted to the upper end of the first cylinder *f*, from the steam-pipe *s*, by a slide-valve *t*, which is held up in the position shewn in the drawing, and with the port closed by a helical spring *u*, on the valve-rod *v*,—one end of the said spring being attached to the valve-rod, and the other resting against a guide-stud *w*, attached to the frame. To the valve-rod is jointed one arm of a lever *x*, represented by dotted lines, which turns on a stud at *y*,—its other arm resting on the periphery of a cam *z*, on the crank-shaft. This cam, which is represented by dotted lines, is concentric from the point 1, to 2; and, during this part of the rotation of the crank-shaft, the valve remains closed by the tension of the helical spring; but from 2, to 1, the cam has an enlargement, which acts on the lever *x*, to depress and open the valve for the admission of steam to the cylinder; and therefore the extent of this cam-like projection, in the direction of the periphery, will determine at what portion of the stroke the steam shall be cut off. After the valve is closed, the steam acts on the piston expansively, until the end of the down stroke; a sliding-valve a^1, then opens a port b^1, which establishes a communication between the upper end of the two cylinders, that the steam may act on the piston *g*, to force it down solely by its expansive force;—the second cylinder *h*, being of much greater capacity than the first, and so much larger, that the steam, acting by expansion therein during the range of the piston, shall exert on it a mechanical force about equal to that which is exerted on the first piston. The stem of the valve *a*^{1}, is jointed to a lever *c*^{1}, that turns on a pin at *d*^{1}, its other end being forked, to embrace an excentric *e*^{1}, on the crank-shaft by which it is operated. The lower end of the second cylinder is always in communication with the condenser by means of the pipe *f*^{1}; and the upper end also communicates with the condenser by means of a passage *g*^{1}, governed by the valve *a*^{1}; and the motion of the valve is such, that at the end of the down stroke of the piston *g*, this passage is opened, whereby the steam from the cylinder is exhausted, and a vacuum established above as well as below the piston. There is a connection or passage *h*^{1}, between the lower end of the first and the upper end of the second cylinder (partly represented by dotted lines); so that when the upper end of the second cylinder is exhausted, the lower end of the first is also, to establish a vacuum below the piston *e*, during its descent; but when the valve *a*^{1}, is opened, to pass the steam from the first to the second cylinder, it also communicates with the lower end of the first cylinder by the passage *h*^{1}; so that whilst the second piston is being forced down by the expanding steam, the first piston is balanced, during its return motion, by the pressure of the steam on both sides of it;—thus making the full pressure of the steam on the large piston available, instead of having it re-act against the surface of the first piston, as in Wolf's expanding engine.

The inventor does not limit himself to the precise proportions or disposition of the crank-shaft, as these may be greatly varied within the principle of the invention, without affecting the result, except in degree. Nor does he confine himself to the combined employment of all the improvements in this part of the invention, as important results can be obtained from either one of them separately: as for instance,—the means of obtaining an equal, or nearly equal, mechanical force on the first and second halves of the semi-rotation of the crank, when using steam expansively, by the principle involved in changing the position of the crank-shaft, relatively to the axis of vibration of the beam, may be advantageously employed, with only one engine, for many purposes. The use of two engines, with the cranks on the same shaft, and on opposite sides of the centre, in combination with the location of the crank-shaft on the principle herein specified, may be advantageously applied to obtain a more regular mechanical action on the crank-shaft, by the use of expansive steam on two ordinary engines, and without the use of the third branch of this part of the invention; and the arrangement of and manner of connecting the expansion engine with the ordinary engine, so as to prevent the steam, whilst acting by expansion alone on the large piston, from re-acting on the small piston, may be advantageously applied, without the use of the first and second branches of this part of the invention; but the best results will be obtained when all three are employed together. Under this part of the invention he claims, Firstly,—placing the axis of the crank-shaft of beam-engines, in which the steam is applied expansively, nearer to the axis of vibration of the beam, on the principle herein specified, and for the purpose of obtaining a more regular mechanical action on the crank by the application of the expansive principle of steam, as described. Secondly,—the employment of two engines, with their cranks on one and the same shaft, and on opposite sides,—that is, at an angle of 180°, substantially as described, when this is combined with the location of the crank-shaft on the principle herein specified. Thirdly,—expansion engines, having two cylinders and pistons, in one of which the steam acts by expansion alone, having one end of the large or expansion-cylinder at all times in connection with the condenser, and the other alternately in connection with the condenser and with the steam end of the other cylinder, that the large piston, during its return-stroke, may have a vacuum on each side, as described; when this is combined with the other cylinder connected with the boiler, and which is so arranged as to have both ends in connection with one end of the larger and expansion-cylinder, so that when its piston is acted upon by the steam there shall be a vacuum on the other side, and when the steam is acting by expansion on the large piston, it shall be in connection with both ends of the small cylinder, as described.

The object of the second part of the invention is to condense the steam without admixture with the condensing water;—that the water produced by the condensation may be carried back to the boiler, to prevent the evil consequences arising from the use of water that contains, in solution or suspension, mineral or other solid matter—and to condense the waste steam blown off from the boiler, to supply the waste arising from leaks, and also for the production of fresh water for any other use. In the fresh-water apparatus a tubular condenser is used, through the tubes of which the steam passes, and is condensed by the cooling influence of a current of cold water, taken from outside the ship or vessel, and made to pass outside of the tubes; and, to this end, the invention consists in combining a condenser of a steam-engine, for the propelling of a ship or other vessel, with a pump that receives the condensing water from outside of the vessel and causes it to pass through the condenser;—the said pump being actuated, irrespective of the engine that propels the vessel, by means of an auxiliary engine,—whereby the amount of condensation can be regulated, independently of the working of the engine that propels the vessel.

Secondly, in connecting the condenser with the boiler or boilers, or any part thereof, in addition to its or their connection with the exhaust of the engine, when the pump, which carries the condensing water through the condenser, is operated by an auxiliary engine; by means of which double connection not only is the steam that escapes from the safety-valve condensed, to be carried back to the boiler, but the boiler or boilers may be used to distil and produce fresh water for any purpose desired, when the engine is not required for propelling the vessel.

And, lastly, in connecting the tubes of the condenser with the cylinder or outer case thereof, by connecting one or both of the diaphragms, to which the ends of the tubes are secured, with the outer cylinder or case by means of a ring, or the equivalent thereof; so that the said ring or flanch may bend to adapt itself to the unequal contraction and expansion of the tubes and cylinder or outer case of the condenser.

At fig. 5, *a*, represents a hollow cylinder, within which are arranged a series of small parallel tubes *b*; and the said tubes are secured at one end, in the usual way, to a diaphragm *c*, which has a turned flanch, through which rivets or bolts *d*, pass, to secure it to the cylinder *a*, and within such distance of the head as to leave a sufficient space between it and the head *e*, of the cylinder, for two chambers *f*, and *g*;—these two chambers being separated by a horizontal diaphragm or partition *h*. The other ends of the tubes are, in like manner, secured to another diaphragm *i*, at the other end; which said diaphragm, instead of being bolted directly to the end of the cylinder, in the usual way, is bolted to a ring *j*, near its outer periphery,—the inner periphery thereof being provided with a turned flanch, bolted to the end of the cylinder. The said ring or flanch should be slightly conical, or bent, that the diaphragm may be at some distance from the end of the cylinder, that it may move in and out, to adapt itself to the unequal contraction and expansion of the tubes and cylinder, by reason of the passage of the steam through the tubes, and the water, for the condensation, through the cylinder. A chamber *k*, is formed at this end of the cylinder by means of a head *l*, secured to the diaphragm by means of a double-flanched ring *m*, and screw-bolts, so that it may be removed, when required, to give access to the tubes. The upper chamber *f*, at the end of the cylinder first described, communicates, by means of a pipe *n*, in any desired manner, with the exhaust-pipe of the engine, and, by another pipe n^1, also with the escape-pipe of the boiler; and these connections should be governed by appropriate cocks or valves, so that either can be closed or opened at pleasure. Either of these connections being opened, the steam passes into the chamber *f*, thence through the range of tubes above the diaphragm or partition *h*, to the chamber *k*, at the other end, and thence back, through the lower range of tubes, to the lower chamber *g*, which communicates, by means of the pipe *o*, with the air-pump and supply pumps of the engine, or (this connection being closed) by means of a pipe o^1, with any desired recipient with which the pipe *o*, may be connected. The direction of the passage of the steam, and the water, produced by its condensation through the tubes, is indicated by the arrows. The steam, in passing through the tubes, is condensed by the cooling influence of a constant current of cold water which passes outside of the tubes, and which travels in a direction the reverse of the current of steam; so that the steam, as it parts with its caloric, is constantly approaching a cooler medium. The water, for the condensation, is forced into the cylinder *a*, near the diaphragm *c*, through a pipe *p*, and passes around the lower half of the series of tubes, until it strikes the other diaphragm *i*; thence it passes up around the end of a horizontal partition-plate *q*, on the same plane as the partition-plate *h*; which plate *q*, extends from the diaphragm *c*, to within a short distance of the other diaphragm *i*; and from this the water passes around all the upper series of the tubes to the first, where it escapes at the top through a pipe *r*, that discharges through the side of the vessel above the water-line.

The water, for the condensation, is impelled through the condenser by a rotating pump, the case *s*, of which is provided with a tangential pipe *t*, at the lower part, connected with the pipe *p*, of the condenser. This case is also provided with another pipe *u*, which extends from the centre thereof to and through the side of the vessel, and so far down as to be always below the water-line, that the water may flow through it to the inside of the pump-case. To the centre of this case a shaft *v*, is adapted, the journals of which run in appropriate bearings *w*, *w*, in the case, and are properly packed, to prevent the escape of water. On this shaft is a hub *x*, with four arms or vanes *y*, accurately fitted to the case, but rotating without touching it. By the rotation of these arms or vanes, the water is drawn in near the centre, and, by centrifugal force, carried out through the tangential pipe *t*, to and through the condenser. The required rotation of the pump is given by an engine a^1, secured to the casing of the rotary pump, through the rod b^1, which is jointed to the cross-head c^1, and connects it with a crank d^1, on the shaft of the pump. This shaft is provided with an excentric e^1, for working the valves of the engine a^1. The water supply-pump, which receives the water from the outside of the vessel, and is, for that purpose, below the water-line, is provided with a valve f^1, the stem g^1, of which passes through a stuffing-box, and has a handle h^1, by means of which the pipe can be closed at pleasure, when it becomes necessary to obtain access to the inside of the pump.

From the foregoing it will be seen that, by means of the auxiliary engine, which actuates the pump, a constant current of cold water is carried through the condenser, independently of the working of the propelling-engine of the vessel; and, as a necessary consequence, the more the propelling-engines labour, by reason of head-winds, or rough water, the more perfect will be the condensation and the vacuum produced,—thus increasing the power of the propelling-engine, when power is the most needed; whereas, if the current of cold water were dependent on the working of the propelling-engine, the sum of the mass of water, passing through the condenser, would be exactly in proportion to the motion of the engine, and, therefore, the condensation and vacuum would be decreased in the ratio of the decreased motion of the propelling-engine. It will also be seen that—by reason of the working of the pump which impels the water for the condensation, by means of an auxiliary engine, and the double connection of the condenser with the waste-pipe of the boiler or boilers, and with the exhaust of the propelling-engine,—whenever the safety-valve is opened, the steam issuing therefrom, instead of being wasted, will be carried through the condenser and condensed, to be returned to the boiler,—thus avoiding the necessity of a separate supply of water to make up for the waste by the escape of steam from the safety-valve. When the propelling-engine is at rest, the condenser can be used for the distillation and production of fresh water for any desired purpose on board ship; for the condenser may, when desired, be rendered entirely independent of the propelling-engine.

By passing the current of steam in a direction the reverse of the current of condensing water, the greatest amount of caloric is extracted with the least amount of water. The condensing water, in its passage though the condenser, never reaches the point of evaporation, and therefore mineral and other matter, held in solution, will not be deposited to incrust the apparatus; and, by insuring a constant and rapid current of water, unequal expansion and contraction is reduced to the smallest amount; so small, in fact, that all injurious effects may be prevented by the mode, above described, of connecting one of the diaphragms, to which one end of the tubes are attached, with the cylinder, by means of the conical or bent ring or flanch.

Under this head of the invention the patentee claims, Firstly,—the combination of the condenser of a steam-engine, used for the propelling of a ship or other vessel, with a pump that receives the condensing water from outside of the vessel, and causes it to pass through the condenser when the said pump is operated by an auxiliary engine, independently of the propelling engine. Secondly,—the double connection of the condenser; that is, with the exhaust of the propelling-engine, and with the boiler, when the said condenser is combined with a pump that receives the condensing water from the outside of the vessel, and is impelled by an auxiliary engine. And, Lastly,—the method of connecting the tubes with the cylinder or external case of the condenser, by attaching the diaphragm, to which one end of the tubes are connected, to the cylinder or external case, by means of the conical ring, or any analogous means; by the bending of which allowance is made for unequal contraction and expansion of the tubes and cylinder or external case, as described.—[*Inrolled, June,* 1849.]

To Alfred Woollett, *of Liverpool, in the county of Lancaster, artist, for improvements in gun-carriages.*—[Sealed 3rd April, 1849.]

This invention consists in certain improvements in, and in the application of apparatus to, the gun-carriages used in fortified places and ships, so as to render it necessary to move only the upper part of the gun-carriage, in training the gun, and by which the recoil is caused to take place from the centre of the port or opening through which the gun is fired.

In Plate XII., fig. 1, is a side elevation of a ship s gun-carriage, constructed according to this invention; and fig. 2, is a plan view of the lower part thereof. *a*, is a 68-pounder gun, mounted on a carriage, composed of two upper cheeks *b*, and two under cheeks *c*; to the upper cheeks a wrought-iron plate *d*, is fixed, and to the under cheeks a cast-iron plate *e*, is affixed; and the two plates are connected together by a pin or bolt *f*, forming a joint, around which the upper part of the carriage can be moved, in order to train the gun to any desired angle, without moving the lower part of the gun-carriage. *g*, is a graduated arc of metal, affixed to the lower cheeks, and designed to support the hind end of the upper cheeks in any position into which the same may be moved around the centre *f*, and to measure the angle of training. *h*, is a regulating screw, for adjusting the position of the upper cheeks. *i*, is a wrought-iron shaft, one end of which is fitted into a recess in the side of the vessel, and the other end is furnished with a hinged socket *j*, by which it is connected to the "fighting" bolt *k*. The shaft *i*, passes through the lower part of the gun-carriage, and is intended to serve as a guide, by which the recoil of the carriage will be caused to take place exactly from the centre of the port. In the fore-part of the gun-carriage, at the place where the shaft *i*, passes through, there are two pairs of antifriction rollers *l*, (fig. 2,) which press against the shaft, and act as a compresser, to diminish the force of the recoil, and prevent the breeching being strained.

By the arrangement above described, the gun is enabled to be trained to an angle of 35° with a line drawn through the centre of the port and the fighting-bolt *k*; but if it should be desired to work the gun at a greater angle, the socket *j*, is lifted off the fighting-bolt *k*, and removed to either of the fighting-bolts *m*, *n*; and then the shaft *i*, will extend from the bolt *m*, or *n*, to the centre of the port, and the gun may be trained on either side of this line to an angle of 35° therewith.

When a gun, mounted on a carriage constructed according to this invention, is to be employed as a bow, stern, or midship gun, instead of the ordinary pivot guns, then the arrangement represented at fig. 3, is adopted. The shaft *i*, is connected at one end by a socket to a bolt *o*, which is in the centre of a circle of fighting-bolts *p*, *p*; and the shaft is connected at the other end by a socket *q*, to any one of the fighting-bolts that may be desired: thus the gun may be directed to all points of the compass.

The patentee claims, as his invention, the improvements in gun-carriages hereinbefore described.—[*Inrolled October*, 1849.]

To Charles William Harrison Pickering, *of Liverpool, merchant, for improvements in evaporating brine and certain other fluids.*—[Sealed 20th March, 1849.]

This invention relates to the apparatus employed for evaporating brine and other fluids, for the purpose of manufacturing salt, copperas, &c.; and it consists in an improved arrangement of apparatus in which a continuous circulation of the fluid is maintained, and the process of evaporation thereby facilitated.

In Plate XI., fig. 1, is a sectional elevation, and fig. 2, a plan view of the apparatus. The evaporating-pan is divided into two compartments *a*, *b*, by a partition *c*, (shewn detached at fig. 3,) formed with two openings *d*, *d*, at the upper part, and an opening *e*, at the lower part of the same, which can all be wholly or partially closed by slides when required. The compartment *a*, of the pan is deeper than the compartment *b*, and contains two sets of steam-pipes *f*, *f*; the upper surface of which is situated below the surface level of the fluid to be evaporated; and they are fixed at such a height above the bottom of the compartment *a*, as to admit of the salt or other deposited matter being readily removed. Steam is admitted into the pipes *f*, *f*, at *g*, *g*, and, after circulating through the same, it is conducted, by the small pipes *h*, *h*, (represented by dotted lines) into the set of pipes *i*, in the elevated pan or cistern *j*. The cistern *j*, contains brine, which is discharged therefrom into the compartment *b*, of the evaporating-pan, from time to time, to supply the loss occasioned by evaporation; and, by the passage of the steam through the pipes *i*, this brine is heated;—the steam and the water produced by condensation are discharged from the pipes *i*, through the small pipe *k*. As the brine, in the lower part of the compartment *a*, becomes heated, by the passage of steam through the pipes *f*, *f*, it ascends and flows through the openings *d*, *d*, of the partition into the compartment *b*; at the same time a corresponding quantity of cooler brine flows through the opening *e*, at the bottom of the partition, into the compartment *a*; and, as this last supply of brine becomes heated, it ascends and flows through the openings *d*, *d*, into the compartment *b*, while a further quantity of cooler brine enters the compartment *a*, through the opening *e*: thus the required circulation of the fluid is maintained.

The patentee claims, Firstly,—the so arranging boiling and evaporating pans that they, being divided, may, by means of openings or sluices, cause the brine or other fluid, when heated, to circulate, and in such manner that the heavier parts will move through the opening or openings at the bottom, and, becoming heated and expanded, will rise and flow out into the other part of the pan through the openings at the top or upper part. Secondly,—the peculiar construction of pan in combination with steam-pipes, whereby one end of the pan, being considerably deeper than the other, admits of receiving the steam-pipes in such a manner as to leave a space below them, so that the brine or fluid, in entering the deeper part of the pan, has to descend, and, becoming heated, gradually ascends and flows back into the shallow part, whereby, being aided by the openings or sluices, a continuous circulation is kept up throughout.—[*Inrolled September,* 1849.]

To Samuel Alfred Carpenter, *of Birmingham, manufacturer, for a certain improvement in, or substitute for, buckles,—being a communication.*—[Sealed 3rd April, 1849.]

This invention consists in a substitute for buckles, in which the strap or band, instead of being secured by a tongue entering an orifice (as in the ordinary buckle), is held in the desired position by a wedging action.

In Plate XII., fig. 1, exhibits a front view, and fig. 2, an edge view, of a brace, with the improved fastening applied thereto. *a, b,* are the parts of the brace which are to be connected; *c, d,* are two metal links or eyes, affixed to the parts *a, b;* and *e,* is a strap (shewn separately, in edge and front view, at figs. 3,) which is passed single through the link *c,* and double through the link *d,* and then, to the ends of it, wedge-shaped pieces of leather or other suitable material e^1, e^2, are fastened. When the strap *e,* has been adjusted to the desired length, the part *b,* is pulled downwards and the strap is fixed in the link *d,* by the wedge e^1, as shewn. If it is desired, at any time, to shorten the brace, the end e^2, of the strap is pulled upwards in the direction of the arrow 1, and the strap is thereby drawn through the link *d;* and, when the brace has been reduced to the required length, the strap *e,* is wedged in the link *d,* by pulling down the part *b.* When the brace is to be lengthened, the strap *e,* is released, and as much of it is drawn through the link *c,* in the direction of the arrow 2, as will produce the increased length; and then the strap is fixed in the link *d,* by the wedge e^1, in the manner above mentioned. It is not absolutely necessary that the pieces e^1, e^2, should be wedge-shaped; for they may have parallel sides, as shewn at fig. 4, if they are made of some soft material.

The patentee states that, although he has only shewn this invention applied to braces, yet it is applicable in all cases where buckles have hitherto been used.

He claims the method, above described and represented in the drawings, of constructing an improvement in, or substitute for, a buckle; that is to say, a fastening to be substituted for the ordinary buckle, in which the several parts are kept in their positions by a wedging action.—[*Inrolled October*, 1849.]

To THOMAS NICHOLAS GREENING, *of the firm of Messrs. Burdekins and Greening, of Sheffield, cutlery manufacturers, for improvements in knives and forks.*—[Sealed 17th April, 1849.]

IN the ordinary mode of manufacturing knives and forks, the blade or prong is attached to the handle by inserting the tang (which is generally much shorter than the handle) into a hole in the centre of the handle, and then filling the space between the tang and the side of the hole with melted resin; and if the handle is required to balance the blade or prong, a piece of lead, of the exact weight necessary to effect this object, is placed at the bottom of the hole, before the insertion of the tang. This mode of constructing knives and forks has several disadvantages: the tangs frequently become loose in the handles from the shrinking or melting of the resin, occasioned by the heat to which they are subjected, particularly in cleaning; and the handles are apt to split and crack, on account of the thinness to which the material is reduced, in order to leave sufficient space for the reception of the lead.

This invention consists in a mode of connecting the blades and prongs with the handles, whereby they will be prevented from being detached by ordinary wear, and by which the use of lead, to make the handles balance, will be dispensed with. In Plate X., fig. 1, represents a knife constructed according to this invention; and fig. 2, exhibits the blade separately. The hole for the reception of the tang *a*, is carried right through the handle; the tang is made of such length as to extend nearly to the end of the handle, and by its weight to make the handle balance; and it is securely fixed in the handle by screwing upon its end the nut *b*, shewn detached at fig. 3. After the tang has been inserted in the handle, the space between it and the side of the hole may be filled with resin, if considered requisite. When the knife is to have a ferrule applied thereto, part of the "bolster" of the knife and the front end of the handle are reduced to a corresponding form, as shewn in the sectional view fig. 4, and the ferrule *c*, is fixed over the same,—thereby rendering the connection of the blade with the handle still more secure. One of the advantages of this invention is, that, in the case of knives, the handles of which are made of ivory, agate, or other valuable material, the blades may be readily removed, when worn or damaged, and new ones substituted.

The patentee has not shewn any forks in the drawing attached to his specification, as the prongs thereof will be attached to the handles in exactly the same way as the blades of the knives.

He claims, Firstly,—the making of knives and forks with tangs of almost the same length as the handles, and passing nearly but not quite through the same, and made fast at the exterior end thereof by nuts and screws, as above described. Secondly,—making the tangs of knives and forks, when elongated as aforesaid, of such size or weight that they shall serve, with the weight of the handles themselves, as a counterpoise to the blades and forks. Thirdly,—the making of knives and forks with ferrules covering in part the bolster and in part the handle, as above described.—[*Inrolled October*, 1849.]

To William Parry, *of Plymouth, Esq., for certain improvements in shoeing horses, and in horse-shoes.*—[Sealed 3rd April, 1849.]

The patentee commences his specification by stating that horses' feet are frequently injured in the act of shoeing, by nails being carelessly driven into the tender part of the foot. To obviate this is the object of the present invention, which consists in affixing suitably-formed shoes to the feet by means of wires.

In Plate XII., fig. 1, exhibits a horse's foot, which has been shod in the new manner; fig. 2, is a plan view of the under side thereof; fig. 3, is a vertical section of part of the same; and fig. 4, is a plan view of the under side of a hoof, with a shoe somewhat different from that shewn at fig. 2. The holes in the shoe are made in pairs, and corresponding holes are drilled in the hoof; the shoe is then affixed to the hoof, by inserting the ends of a bent piece of wire *a*, through each pair of holes in the hoof, and through the holes in the shoe beneath, and twisting the ends of the wire together; and then the twisted parts are either bent down into the fullering groove (as represented at a^1, fig. 2,) or into recesses made for that purpose (as shewn at a^2, fig. 4,): when the shoe is formed with recesses, these are afterwards to be filled with iron cement. The holes in the shoe, for the wire to pass through, are circular; and they are made only just large enough to receive the wire, which will vary in size according to the weight of the shoe. It is stated that this invention will be found advantageous, because holes may be readily drilled with great accuracy, without fear of injuring the foot; and, when the holes have been made, the wires may be inserted and the shoe secured by an ordinary labourer.

The patentee claims the means, above described, of applying and affixing horse-shoes, and the modification of horse-shoes, to render them suitable for such means of applying and affixing.—[*Inrolled October,* 1849.]

To GASPARD BRANDT, *late of Little Gray's Inn-lane, in the county of Middlesex, but now of South Ville, Wandsworth, in the county of Surrey, machinist, for improvements in the construction of the bearings of railway engines and railway and other carriages now in use.*—[Sealed 13th April, 1849.]

THIS invention consists in the application to the bearings of locomotive engines and railway and other carriages of anti-friction wheels or rollers, which are designed to bear upon the arm of the axle, and permit the same to turn with less friction than when the ordinary bearings are employed.

In Plate XI., fig. 1, is a side elevation of one of the improved bearings, applied to a locomotive engine or railway carriage; and fig. 2, exhibits the interior of the bearing,—the outer plate being removed for that purpose. The bearing consists of a metal case, which is secured to the axle-guards *a, a,* by the metal straps *b, b,* in such manner as to permit it to rise and fall freely; and at the top it is attached to the spring *c*. The case contains the antifriction wheels or rollers *d, d,* the spindles or axes of which turn in suitable openings made for that purpose in the outer plate *e,* (fig. 1,) and the inner plate *f,* (fig. 2,) of the case. The end or arm of the axle *g,* enters the case through a notch or slot (seen in fig. 2,), which is made of such width as to receive the axle without its sides coming into contact with the latter; and the top of the slot is semi-circular, so that, in the event of the antifriction-rollers being broken or displaced, it will bear upon the axle and support the body of the carriage or engine.

When this invention is to be applied to the wheels of carriages and wagons, to run on common roads, the nave must be made larger than usual, so that a suitable opening may be formed therein for the reception of the antifriction wheels or rollers, which are to be substituted for the ordinary bush or box.

The patentee claims the construction of the bearings of such railway engines and railway and other carriages, as aforesaid, with antifriction wheels or rollers, in manner above described.—[*Inrolled October*, 1849.]

To Robert Gordon, *of Heaton Norris, Lancashire, engineer, for certain improvements in the ventilation of mines.*—[Sealed 4th April, 1849.]

This invention consists in an improved mode or modes of ventilating mines, by which a larger and more uniform amount of air is passed through the workings than can be effected by the ordinary methods of ventilating mines.

Mines of any extent, especially coal mines, where carburetted hydrogen, choke-damp or carbonic acid, or other noxious gases are liberated, are commonly provided with two shafts, called the downcast and upcast; and at the bottom of the latter a large fire is generally kept burning, for the purpose of rarefying the air, which ascends the upcast shaft and produces a current through the workings,—a corresponding supply of fresh air descending through the downcast shaft into the workings. If the mine is only provided with one shaft, this is divided, vertically, by an air-tight partition or brattice, into two divisions,—one serving as the downcast and the other as the upcast shaft. In this system of ventilation, the fire for producing the current occupies a dangerous and inconvenient position;—it is liable to be neglected by the stoker, who frequently inhales a disagreeable atmosphere, producing heaviness and sleep; and, if an explosion takes place, the workings become so charged with choke-damp, that the ventilating fire is extinguished, and all animal life destroyed, leaving no means to clear the workings of the deleterious gas. The ascent of the rarefied air in the upcast shaft is also impeded, and the ventilating power of the furnace contracted, by the constant oozing of water from the sides of the shaft, which reduces the temperature of the upward current; so that, on a strong wind forming an eddy at the top of the upcast shaft, or a sudden fall of the barometer, the ventilating action of the fire will be suspended.

The improved means for ventilating, which forms the subject of this invention, is represented in Plate XII.; fig. 1, being a vertical section of the ventilating apparatus and the upper part of the upcast shaft, and fig. 2, a plan view thereof, partly in section. *a, a, a,* are three steam-boiler furnaces (but any other number may be used), situated near the upcast shaft *b,* which is closed at the top airtight; from the upcast shaft an air-course or culvert *c,* is carried underground and divided into three branches c^1, which severally enter into the ash-pits *d;* and as these ash-pits are closed in front by doors, *e,* all the air to support combustion must be drawn from the upcast shaft, and thereby produce a rapid current through the workings of the mine. A continuation of the centre passage c^1, enters the chimney *f,* as indicated by the dotted lines; and this may be opened when the steam is up and the furnaces do not require attention, so as to permit the air to proceed direct from the upcast shaft into the chimney, without passing through the furnaces: by this arrangement, the ventilating power of the chimney is not checked by dampers, when the steam gets too high, but is modified by the admission of air from the culvert; and if at any time the air from the upcast shaft should contain sufficient carbonic acid to endanger the combustion of the furnace or furnaces, pure air may be admitted into the ash-pit by opening the door *e.* Each of the air-courses c^1, is furnished with a valve *g,* by which all communication with the upcast shaft may be cut off when the furnace requires repairs.

The mode of adapting this invention to a mine provided with only one shaft is exhibited at fig. 3, which represents a shaft divided by a brattice *h,* into two parts *b,* and b^1,—the former constituting the downcast shaft and the latter the upcast shaft, which is closed at the upper part, and communicates with a furnace or furnaces by the air-course *c.*

The patentee also shews another arrangement of ventilating apparatus, consisting of a large chimney, around the base of which four furnaces (without boilers) are built; the upcast shaft communicates directly with the chimney by means of an underground air-course or culvert, which enters the chimney in the same manner as the continuation of the centre passage c^1, in fig. 1; and each furnace is connected with the chimney by two passages—one for conveying air into the ash-pit, and the other for discharging the products of combustion into the chimney.

The patentee proposes to close the top of the downcast shaft at any convenient opportunity, when the miners are absent from the mine, and at the same time to keep up the ventilating fires until the workings are exhausted, equivalent to a column of one inch of water or more: by this means the light explosive gas would be effectually extracted from the charged receptacles; as, on the atmospheric pressure being reduced in the mine, the highly-charged cavities would discharge part of their contents; and, when pure air was allowed to rush into the workings, the explosive gas in the recesses would become mixed with air, and its dangerous power destroyed.

The position in which the chimney and furnace are placed, as regards the upcast shaft, may be varied; and a similar effect to that above mentioned may be obtained by building the chimney within the upcast shaft,—leaving an opening or annular space between it and the native rock, to allow the water to descend without cooling or impeding the ventilating current, which is produced by an ordinary furnace, at or near the bottom of the upcast shaft.

The patentee claims the novel construction and arrangement of a chimney with a furnace or furnaces in connection with the upcast shaft of a mine, for producing a more perfect ventilation, as above described,—including the closing of the downcast shaft as occasion may suggest, as above mentioned. —[*Inrolled October*, 1849.]

To William Little, *of* 198, *Strand, for improvements in the manufacture of materials for lubricating machinery,—being a communication.*—[Sealed 16th April, 1849.]

This invention consists in employing products of petroleum in the manufacture of materials for lubricating machinery.

The patentee subjects the petroleum to distillation, in order to obtain products therefrom. The first product which comes over is employed, on the score of economy, for the production of light; the subsequent product, which is of a greasy character, is received in a separate vessel, in order to be employed in the preparation of lubricating materials; and the distillation is continued as long as there is a sufficient quantity of petroleum or residue in the still to prevent the latter from being burned. To manufacture a lubricating material, thirty-two parts of tallow, or other suitable fatty matter, and seventy-five parts, by weight, of soda ley, of from 10° to 11° Beaumé, are introduced into a large copper or cauldron, and heated to the boiling point; then twenty-nine parts of water are added, and the mixture is again brought to the boiling point; after which it is poured into a vessel containing forty-five parts of the greasy products of petroleum, and thoroughly stirred up therewith; and when the mass has become cool, it is ready to be used for lubricating machinery.

When the lubricating material is required to be of a more liquid character, the patentee takes the more fluid parts of the greasy or oily products which first come over, and boils the same with about 10 per cent. of soda ley; and when a thick white vapour appears, he allows the matters to cool down: the composition may then be employed for lubricating purposes.

The patentee states that he does not confine himself to the details above given, so long as lubricating materials for machinery are manufactured by the application of products of petroleum.—[*Inrolled October*, 1849.]

To Charles Iles, *of Bordesley Works, Birmingham, machinist, for improvements in manufacturing picture-frames, inkstands, and other articles in dies or moulds; also in producing ornamental surfaces.*—[Sealed 26th April, 1849.]

The first part of this invention relates to the manufacture of picture-frames, inkstands, bobbins (for cotton and other thread), buttons, and other articles which can be made by subjecting a plastic composition to pressure in dies or moulds; and it consists in combining colored silk waste or other colored fibrous substances, or a mixture of colored silk waste and other colored fibrous substances with plastic matters, so as to give a veined or marbled character to the surface of the above-mentioned articles.

The plastic composition preferred to be used in carrying out the invention is composed of four parts, by weight, of resin, one part of wax, six parts of glue, four parts of alum, and twelve parts of gypsum. The resin and wax are melted in any convenient vessel; then a hot solution of glue is added thereto; after which the alum and gypsum, in powder, are introduced; and then the whole is well stirred. Into the composition thus produced (which may be colored, if desired) the fibrous materials, above mentioned, are stirred, and then the composition is cast into moulds: the colored fibres which come to the surface give a veined character thereto; and such will be the case if other plastic matters than those above mentioned are used.

The second part of the invention consists in producing ornamental surfaces on walls and other places, and on different matters or substances, by combining colored silk waste or other colored fibrous substances, or a mixture of colored silk waste and other colored fibrous substances, with cement, in such manner that the colored fibrous materials shall give a veined or marbled character thereto.

In carrying out this part of the invention, Keene's cement, or any other cement producing a smooth hard surface, is employed; and with such cement the patentee mixes the colored silk waste or other colored fibrous materials,—taking care that the color or colors of the materials used be different from that of the cement. The fibres are mixed with the cement in a similar manner to the mixing of hair with mortar; and such cement is spread on the wall or other surface and "floated" and laid smooth, as when like cements are used without being mixed with colored fibrous materials.

The silk waste or other fibrous material is dyed of the required color by the ordinary operation of dyeing.

The patentee claims, First,—the mode of manufacturing picture-frames, inkstands, and other articles, in dies or moulds, by combining colored silk waste or other colored fibrous substances with plastic matters, so as to obtain a veined or marbled character to the surfaces of such articles. Secondly,—the producing of ornamental surfaces to walls and other places, and on different matters, by combining colored silk waste or other colored fibrous substances, with cement, in such manner that the colored silk waste, or other colored fibrous matters used, shall produce a veined or marbled character.—[*Inrolled October*, 1849.]

Scientific Notices.

ON COMMERCIAL SOPHISTRY.

Frederick Schlegel, when discoursing, in his *Philosophy of History*, on the intellectual culture of the ancient Greeks, dates the decline of their national greatness from the growth of the "pernicious art of a false rhetoric," introduced by the sophists, who, by wrongly interpreting the writings of the early philosophers, caused perplexity where before harmony of thought existed; and thereby effected a distaste for true science and genuine art. If from this source (for the soundness of the opinion can scarcely be doubted) such subtle poison could have been distilled as to effect the destruction of a nation, the magnitude of whose achievements command the admiration of the world, and bid fair to retain it to the end of time,—it would be well for mankind to guardedly receive all newly propounded theories, of whatever nature, and to carefully test their value previously to accepting them as the basis for their actions; and, much more, before handing them down, impressed with the stamp of truth, for the use of after ages. Yet this is far from the practice of the present day; for we are too often content to adopt and cling to a fallacy, until compelled by the very force of circumstances to relinquish it. We were, perhaps, led to embrace it by being blinded by a false rhetoric; but more probably through taking the notion upon trust from some person who had first clouded his own reasoning powers, by allowing them to fraternize with self-interest, or become eclipsed by the dazzle of an unrestrained imagination. In the present age, while, for the purpose of effecting an economy in production, all kinds of industry are spreading into branches, which themselves again form numberless ramifications, it is not to be wondered at that a division of labor in intellectual pursuits should also take place; and that many should fall into the habit of receiving, without question, the dictum of any plausible man who may set himself up as an authority upon a given subject; for, by that means, one journey (which the self-constituted authority may be supposed to have taken) through an intricate maze of thoughts and reflections, will suffice for the direction of many minds. So general indeed has this practice become, that it has been found comparatively easy to work on the credulity of the public in all matters involving something more than a general knowledge of commercial transactions, or, still better, an acquaintance with science, however small the amount; and, in consequence thereof, a new and very profitable branch of sophistic art has arisen; whereby, as with the marvellous power of an Aladdin's lamp, the secret labyrinths to hidden treasures are made to unfold before the eyes of all whose surplus cash lies useless in their coffers. It might be considered invidious, when so many deserve the highest credit for the success with which they have cultivated and developed this modern science, to single out one from the long list of professors as a type of the class; but, as there is fortunately one who must, on all hands, be acknowledged to have far o'ertopped the rest, we feel no scruples of delicacy in naming him. The illustrious head, then, of these professors, is none other than the great king Hudson—great from the skill and courage which he displayed in acquiring a pre-eminent position, but greater far from the memorable character of his fall. It is not our purpose to discuss the events of the short but brilliant reign of the railway king, or to sentimentalize over the turns of fortune which wrought his deposition, for these matters have already been sufficiently canvassed, and are of too recent a date to require further comment: it is to the class, and not the individual, that we would call attention. Sophistry, in its generally accepted sense, is now, perhaps, as much cultivated as at any former period of the world. In religion, morals, philosophy, politics, law, and in all the sciences, we have the sophist spreading out his nets of entanglement; and if, while possessed of less cultivated intelligences than the ancient Greeks, we are better able to escape the danger of these snares, it can only be ascribed to the light of *truth* which each man possesses within him,—but which the ancients blindly and fruitlessly groped after in the darkness of heathenism. This light, however, although it is admirably suited to direct and strengthen man's moral faculties, affords no protection against that new branch of the sophistic art above alluded to, viz., commercial sophistry; and hence the rich harvests which are obtained from the helpless dupes of fraudulent speculations, while the learned sophist, by his well-studied harangues, and ingenious disquisitions, will scarcely obtain a convert to his opinions. We are led to these reflections from a retrospective review of the many joint stock companies which, in our remembrance, have arisen, with promises of golden harvests to be reaped under their shadow,—promises, we need scarcely add, which were never realized.

As imposition is a thing to which all men are liable in a greater or less degree, and on some subjects more than others, it is necessary for the commercial sophist first to find out some weak point, which is common to a large body of speculators, and his road to success lies clear before him. Now, we have said, that the public is most credulous upon matters of science,—it is from a knowledge of the existence of this feeling that many an El Dorado scheme has been thrust forward, in the shape of a joint stock company, with no other object than to feather the nest of the promoters; while others, propounded by honest but self-deluded enthusiasts, although equally unpossessed of the elements of eventual success, have readily found support: in either case sophistry was the dram administered to lull the senses of the confiding public, and raise up the pleasing vision of exorbitant returns. It would seem, that in all schemes of the nature to which we allude, *novelty* is a requisite ingredient to make them acceptable; and hence new inventions have been most generally chosen as an ostensible base for these kind of transactions. To uninitiated minds there is something mystic about the term "a new invention,"—it may be that some great secret of nature, which has hitherto baffled the skilful investigations of man, is now, for the first time, discovered, and a mighty power is thereby made subservient to his will—or, that some natural product, which has hitherto been regarded as worthless, is now capable of being converted into substances of universal demand—for many marvellous discoveries have of late been made, and why not yet another? This therefore is safe ground to start upon, inasmuch as it gives the credulous an opportunity of indulging their credulity, while, at the outset, the possibility of the promoter's statements being disproved is guarded against by the secret of the invention being in the first instance preserved. A suitable subject having been chosen, say, for instance, *a new motive power,*—the skill of the sophist is now brought into play, and, dependent upon the ability which he employs, is the success of his project. It is his business to demonstrate to the world the costliness of steam power, and the danger of explosions therefrom; and to shew its inapplicability to many purposes for which animal power only has been hitherto employed. He has then to set forth the advantages of the new system, and to draw a comparison between the two. If there is sufficient plausibility in the invention itself, he prepares a case for some engineer of celebrity, and obtains in reply thereto an ambiguous opinion, which, confirming in the main the statements as to cost and danger of steam, is ingeniously made to read in favor of the new project. Armed with these documents as his ammunition, he now proceeds to give the world the benefit of his labors. A paragraph, after the fashion of a premature announcement, is first made in a daily paper, stating the existence of an invention calculated to supersede the use of steam, and dimly shadowing forth its nature; while the incalculable advantages which may be expected therefrom are forcibly dwelt upon. This statement is quickly re-echoed by the press in town and country, and thus a suitable sensation is produced. Then follows an official preliminary announcement respecting the formation of a company to purchase and work this wonderful invention,—which, in the mean time, is being secured by the inventor under Her Majesty's Royal Letters Patent, on the understanding that he shall transfer all his rights in the patents to the company for a certain specified sum. When these grants are obtained, the scheme assumes a bolder front, inasmuch as there is now at least something tangible;—a managing committee (composed, if possible, of men of capital) is thereupon to be got together, and a banker, a solicitor, and an engineer (usually the patentee, who is the puppet of the projectors) are nominated. It is at this stage of the business that the full powers of the sophist are required to be employed; for it is not enough that his false rhetoric is brought into play, but he must first carefully choose his auditors. It would, of course, be rash and impolitic to get on to his committee any who were at all acquainted with science, while so many could be found destitute of that knowledge; he therefore selects for his purpose prosperous men, who, although possessing a public reputation for shrewdness in commercial matters, make no pretension to a grain of knowledge beyond their own occupations. These are only to be obtained by tact; but that they can be secured when the proper bait is held out, the experience of many a wealthy alderman will testify, who has taken his first lesson in practical science as a managing director of a joint stock company. When the committee is formed, and the private arrangements for purchasing the invention are completed, it is time to allot shares, and obtain therefrom a fund sufficient for meeting the demands of the inventor for publicly exhibiting the invention, and for getting a parliamentary grant of incorporation. Out of this first pull upon the shareholders, the promoters of the scheme usually find enough to reimburse themselves for their trouble and expenses; and by the time they have withdrawn from the speculation, the scheme is blown, and the committee is left to make up all deficiences. Thus, with very little variation, except in minor details, are joint stock companies got up. But, it may be asked, how is the public to judge between rational and irrational projects when both, at starting, assume the same complexion? To such a question we would reply, that the only plea for the formation of a trading company at all is, that a large capital is required for carrying out the project to an extent that will render it *commercially* successful; but, to ascertain its theoretical truth, or to test its practicability, is commonly within the means of a single individual; and steps for obtaining, at least, this guarantee of success, ought always to be taken before the public is called upon for pecuniary assistance. There are comparatively few men who would rush, single handed, into a speculation, of the probable success of which they felt themselves incompetent to judge. Why then should they run in herds at the cry of the wily commercial sophist? It would be well if a touchstone could be found, whereby the commercial world could as readily detect the subtleties of false rhetoric, when devoted to the destruction of confidence in speculation, and the consequent disorganization of industry, as can the philosopher or the mathematician in their respective pursuits. But while such a desirable auxiliary is wanting, and people are still found eager to accept the syren invitation to commercial ruin, it might be well for government to interpose a shield of protection, by rendering illegal the formation of trading companies, which manufactured for other than their own use; for, even when established with the *bonâ fide* object of carrying on a branch of manufactures, they bear most oppressively on the private manufacturers with whom they compete,—without any adequate advantage accruing to the community; while, by admitting of the possibility of joint stock companies being formed for promoting any wild and impracticable scheme, the door is open to fraudulent speculators, who far too frequently succeed in enriching themselves at the expense of honest and deserving industry.

ON THE AURIFEROUS SANDS OF NEW GRANADA AND THE URAL MOUNTAINS.

[Translated for the London Journal of Arts and Sciences.]

In this paper, which may be considered as a continuation of that published in our last number, "On the auriferous sands of California," M. Dufrénoy makes an analytic comparison between the several kinds of gold upon which he has been experimenting. The sample of New Granada gold sand, which was placed in his hands, was collected in the valley of Rio Dolce, in the province of Antioquia; it is like that from California, almost entirely crystalline; but the forms of the crystals of the titaniferous oxide of iron and of zircon were in even better preservation. This sand was of a greyish tint; on acting upon it with the magnet 6 gr. 70 of sand only furnished 2 gr. 30 of oxide of iron, or 34·35 per cent. After the operation of the magnet, the remaining sand was found to consist of titaniferous oxide of iron, oligistic iron, zircon, and quartz. The two first minerals, although abundant, were not nearly so plentiful as in the sand formerly described. M. Dufrénoy did not, in this instance, count the grains, most of them being so small as to render it difficult to do so; he merely estimated them by separating, as far as possible, the different kinds of grains under the microscope. The result of this shewed their composition to be as follows:—

Magnetizable oxide of iron (exact quantity obtained)	34·35
Titaniferous oxide of iron and oligistic iron	15·00
Zircon	20·00
Quartz	25·00
Corundum	1·00
Opaque yellowish-grey rock, probably quartz, iron pyrites, and gold	4·65
	100·00

Amongst the crystals of titaniferous oxide of iron and oligistic iron, a certain quantity had preserved their forms so perfectly as to be easily recognized. They were generally very brilliant; the zircon crystals were also very perfect at both ends, and were of the orange color peculiar to that mineral. These crystals were somewhat longer than those from the Californian sands, and, although identical in form, differed essentially from them in the extension of their faces. They were square prisms, surmounted by a long dioctahedron, ending in very short facets. They were only perceptible in a projection of the crystals at an obtuse point which terminates them. The quartz, which was almost always fragmentary, was very little worn; and some perfect crystals were distinguishable.

It may be generally remarked, that the auriferous sands of New Granada are less worn than those of California, which leads to the belief that they do not come from so great a distance. In fact, the distance of the Andes from the valley of Rio Dolce is but 80 kilometres, whilst the valley of the Sacramento is nearly 400 kilometres in length. The sands of New Granada are less rich in protoxide of iron than those of California, which might arise from their not being so well washed;—with this exception, they are identical in composition. This would lead to the conclusion, that the mountains, from the wearing or disintegration of which these sands have been produced, are of the same nature; and that the Andes are perfectly identical for a distance of upwards of 4800 kilometres. The regularity of this chain, which forms all along a barrier to the ocean, naturally leads to this idea; but, this being only a crude guess, some confirmatory facts are required. A study of the different sands furnishes us with more minute details than could be obtained by mere geological research; as the minerals they contain are disseminated in very minute quantities in the rock, and the diluvian phenomena, which caused their separation from the rock and imbedded them in a shifting soil, offer a ready means of studying their constituent character.

Sand from the Ural Mountains.

M. Dufrénoy further states, that he examined two varieties of sand from the Ural Mountains; one of which was sent by the

Russian government to M. Becquerel, and which he sent to the Museum of Natural History, and the other was collected by M. Le Play at the washings. The former is, doubtless, a less concentrated product than the latter; it contains only 10 per cent. of oxide of iron,—most of its component fragments being quartzose. The second contained 22·12 of oxide of iron, capable of being acted upon by the magnet.

M. Dufrénoy has obtained some valuable information from M. Le Play (attaché to the scientific Ural expedition) relative to the washing of auriferous sand; which will allow of some conjectures respecting the richness of the Californian sand. M. Le Play made numerous experiments, for the purpose of ascertaining the yield of gold in the auriferous washings of the sands of the Ural Mountains; and he found that the richest gave 0·0000008, whilst some sands were operated upon which only contained 0·0000001 of gold. The sand furnished by M. Le Play was of the first kind; it had been so concentrated that 100 grammes of washed sand were obtained from 3200 kilogrammes of raw sand. Its richness in gold was therefore 0·00256. The quartz, so abundant in M. Becquerel's sand, was comparatively rare in this. It belonged to three varieties, viz., colorless hyalin quartz, amethyst quartz, and cloudy quartz. The most abundant mineral appeared to be the titaniferous oxide of iron; it is black, with a brilliant lustre, slightly resinous; the grains are generally rounded and devoid of form, so that the oligistic iron could not be distinguished. M. Dufrénoy is of opinion that, if this latter oxide of iron exists in these sands, it is very scarce, as he was not able to separate the grains furnishing the red sand. He remarked some long grains of a somewhat prismatic form, which resembled mengite, a mineral found in considerable quantities in the Ural Mountains.

Transparent opal-like, greenish-yellow grains, are also distinctly visible in this sand;—these grains appear to belong to the cymophane genus; also crystals of white zircon, the forms of which were recognizable, although their edges were somewhat blunted,—the faces of the octahedron predominating, and the crystals being elliptic.

The grains of this variety of sand from the Ural Mountains are generally very much rounded, and, consequently, bear the traces of much friction, and have, perhaps, travelled a long distance. Their dimensions are generally uniform,—sufficiently so to allow of their being counted. The relative proportions furnished by this cursory kind of examination were as follows:—

Magnetizable protoxide of iron, attracted by the magnet	23
Titaniferous protoxide of iron? mengite? &c.	50
Cymophane	10
Hyalin quartz, of various kinds	14
Zircon	3
	100

Besides this it contains iron pyrites and copper pyrites. M. Dufrénoy found the specific gravity of the sands of the Ural Mountains to be 4·53, which is somewhat higher than that of the Californian sands: this would lead to the belief that they are richer in protoxide of iron and in oligistic iron than the latter. The composition of the Ural sands appears to be very different from those of America; the latter contain 59 per cent. of protoxide of iron, and the others 23; the Ural sands contain, on the contrary, 50 per cent. of titaniferous iron, whilst the American only contain 15 or 16 per cent; but the most remarkable difference consists in the presence of cymophane, which is contained in the Ural sands in the proportion of at least 10 per cent.; Zircon exists in the Ural sands in but very small quantities; and quartz, which is one of the essential elements of all crystalline rocks, is found in equal abundance. The proportions to be observed in the concentrated auriferous sands is not nearly so great as in the rough alluvion; but the specific gravity of the quartz being only 2·7, whilst that of the protoxide of iron is 5·09—that of the zircon 4·50,—and the cymophane 3·68: the greatest portion of the quartz will be eliminated if the washing be carried on to a sufficient extent.

Sand from the Rhine.

Finally, Mr. Dufrénoy examined some auriferous sand from the valley of the Rhine, which was presented to the collection of the Museum of Natural History by M. Menard de la Groye; the precise locality is not stated, nor its degree of concentration: this latter cannot have been very great, judging from the proportion of protoxide of iron separated by the magnet, which did not amount in the whole to 2 per cent. The sand remaining contained brilliant black grains, similar to the titaniferous iron,—the proportion was small,—it was not estimated, but did not appear to exceed 3 or 4 per cent. Quartz was not merely the predominant element, but almost the only one present, amounting to at least 90 per cent; it was hyalin, but of various hues, viz., colorless, cloudy, deep topaz, yellow, and pink,—the latter variety being abundant. In the midst of this multitude of grains of quartz a few crystals of white zircon might be distinguished, the edges of which were rubbed,—the quartz existing in angular fragments. The remarkable difference between the wear of the crystals of zircon and the grains of quartz might, perhaps, arise from the mixture of soils of different periods.

M. Dufrénoy states, that he did not observe any spinel in any of the auriferous sands which he examined. Is the absence of this substance fortuitous, or is it the result of a general cause? He says, he should be induced to adopt the latter opinion; he also says he found spinel in great abundance in the stanniferous sands of Pyriac, and also in tin washings in Cornwall; and that it might be concluded, that this mineral belongs to crystalline rocks of more ancient origin than those in which gold is found.

M. Dufrénoy stated previously that an accurate knowledge of the richness of the Ural sands in gold would enable an opinion to be formed respecting the richness of the Californian sands; in fact, the density of these sands being very similar (4·37 and 4·53), it may be admitted, that the washing operation concentrates both of them in nearly equal proportions. Now, the washed Ural sand contains 0·00256 of gold, and the Californian sand gives a result of 0·0029; this latter, although greater than the former, approaches very near to it. This hypothesis appears also to be verified by other facts: for instance—Russia produced, in 1847, a quantity of gold estimated at 77 millions of francs; the number of workmen employed in washing, in that empire, amounted to about 50,000. According to the documents published upon California, in the American and English journals, it appears that the gold produced amounted to from 4 to 5 millions of dollars, or from 20 to 25 millions of francs; the number of workmen being from 15 to 16,000. Now, 25 millions are about one-third of 77, as 16,000 are about one-third of 50,000;—thus, the same number of workmen would produce about the same quantity of gold. There would, therefore, seem to be an analogy between the richness of the washed sands of the Ural Mountains and those of California, and the rate of production of the workmen. It may then naturally be concluded that the auriferous diluvion of California appears to bear analogy, as regards richness, with other gold washings.

The important discovery of gold in California may, at first, prove of very great advantage,—either because the first seekers hit upon exceedingly rich placers, or from some other fortuitous cause; but the ratio of production will soon become lowered to a mean level, which will give to the product its true standard value.

The products of the Russian mines, which are known officially, allow of our arriving at an approximative estimation of the quantity of gold obtained by each workman. It is only necessary to divide 77,000,000 by 50,000; from this it appears, that each workman produces, annually, a quantity of gold equal to 1540 francs. Supposing, from local circumstances, that the workmen only work 200 days per year, the net daily produce of each workman would only amount to 7 fr. 70 c.

On comparing the working of gold mines with those of iron, it will be remarked, that the advantage is in favor of the latter; in fact, it will be found, on reference to the *Comptes Rendus des Ingénieurs des Mines* for 1847, that the production of cast and wrought-iron amounted in that year to a sum of about 191 millions; and that the number of workmen employed in different ways in this branch of industry, was 33,000.* The produce of each workman was therefore, in that year, 5788 francs; and, from the frequent cessation from work, from scarcity of wood and other causes, it is reasonable to suppose that each workman works at the most 250 days per annum. In this case the daily produce would be 23 fr. 15 c.; or, supposing them to work 300 days, it would amount to 19 fr. 25 c.

In order to make a true comparison between the advantages of working gold and iron, it would be necessary to state the amount of capital respectively employed in these two branches of industry. We are not in possession of documents which will enable us to do this, but we are aware that the production of iron involves a much larger expenditure than that of gold. At any rate, it appears certain that the value produced by each workman in iron is at least equal to that produced by those working gold.

M. Dufrénoy is of opinion that the above calculations, however incomplete the data may appear, are sufficient to warrant the conclusion, that gold is found in California under nearly the same conditions as in other places hitherto known.

The advantages will therefore prove analogous, and will depend entirely upon the price of labor, as in working auriferous sands the outlay consists almost exclusively in carriage and washing; at all events they could not, under any circumstances, be very considerable, as the produce of each laborer could not be estimated at more than from 9 to 10 francs per day. The discovery of gold in California will not, therefore, produce the revolution in mineral industry which was supposed; but, at the same time, will doubtless prove, for that new State of the American Union, a source of riches and civilization.—[*Comptes Rendus.*]

ON A SIMPLE APPARATUS FOR ELECTRO-GILDING AND SILVERING.

BY M. LE DOCTEUR L. PHILIPP.

It has long been a question of interest to electrometallurgists whether the operation of gilding and silvering of articles (of whatever form) could not be effected by an apparatus of less complex construction than that at present in use. As a solution to this question, M. Philipp offers the following information:—The vessel required for this purpose must be made of the same material as that ordinarily employed for flower-pots; before being used it must be tested in the following manner. If, on being filled with water, it simply becomes damp, without allowing the water to filter through, it is fit for use, but not otherwise.

It will of course be understood that the dimensions of the ves-

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* Number of workmen employed in the production of iron (*Comptes Rendus des Ingénieurs des Mines*, 1847).

For extracting iron from ores	15,000
For working blast furnaces	5,000
„ „ forges	13,000
	33,000

sels, and modifications to be made in the apparatus, must vary according to the size of the articles to be operated upon.

I. When a number of small objects are required to be operated upon, the apparatus may be mounted in either of the following ways:—

1st. The porous earthen vessel, already mentioned, shewn at *a*, fig. 1, Plate XII., is surrounded by a cylinder of zinc, and then introduced into another vessel (a wooden tub for instance) containing dilute hydrochloric or sulphuric acid. The earthen vessel is intended to contain the solution of gold or silver, and is furnished with a web of copper wire *b*, which is made to communicate with the zinc by means of one or more conducting wires, as shewn at *c*. The objects to be gilt or silvered are placed upon the net-work *b*.

2nd. The earthen vessel *a*, fig. 2, containing a zinc cylinder *b*, and some hydrochloric acid, is introduced into another vessel *c*, containing the solution of gold or silver, and placed in the centre of a wire web partition *d*, which communicates with the zinc cylinder by means of a conducting wire *e*. In the first case, the articles which are to receive the thickest coating are placed nearest the outer sides of the apparatus; in the second, nearest to the earthen vessel *a*;—in both cases it is advisable to shift their position occasionally.

3rd. By combining these different arrangements, the deposit obtained is more abundant and more equally distributed upon the surface to be gilded or silvered. For this purpose an opening is made in the centre of the web *b*, (fig. 1,) in which the apparatus *a*, *b*, *d*, *e*, (shewn at fig. 2,) is inserted, the zinc cylinder of which communicates with the wire web.

4th. When the articles to be operated upon are of such a nature that they can easily be suspended from a given point, the web of the apparatus (fig. 1,) may be made with wider meshes, and the articles suspended vertically between them.

II. If large articles are to be treated, the apparatus must be modified accordingly; for instance:—

1st. For solid articles, of any form, the apparatus shewn at fig. 1, only is required, but without the wire web,—the article being immediately connected with the zinc by means of a wire.

2nd. For hollow vessels, such as dishes, plates, &c., which require to be coated as thickly on the inside as the outside, the same apparatus is employed, with the addition of a second, which is held suspended by means of a support *a*, as shewn at fig. 3. The zinc cylinder, forming part thereof, is then put in communication with the inside of the vessel, by means of the wire *b*; and that of the exterior of the apparatus with the exterior of the same vessel, by means of the wire *c*.

3rd. If the interior or hollow portion of the article is to receive the thickest coating of gold or silver, a vessel is to be substituted for the exterior apparatus; but when the outside is to be most thickly coated, the suspended apparatus is dispensed with altogether.

4th. Lastly, if a hollow vessel is merely required to be coated inside, only the support and the apparatus suspended thereto are to be employed.

The cases above instanced are those which most commonly happen in practice; but should any occur which are not included in the above category, the modifications necessary for meeting them will be readily understood. Care must be taken to employ a galvanic current of power proportioned to the bulk of articles to be operated upon; this will be easily ascertained by experience. The weaker the current, in proportion to the size of the zinc, the slower (although more perfect) will be the precipitation of the precious metal.

M. Philipp states, that he has had much experience in the working of galvanic batteries, and has found the employment of the simple apparatus to be attended with considerable advantage; so much so, that persons who have tried both methods carefully have given up entirely the use of the battery ordinarily employed. —[*Technologiste.*]

REPORT OF THE COMMISSIONER OF PATENTS TO THE SENATE OF THE UNITED STATES,

ON THE SUBJECT OF STEAM-BOILER EXPLOSIONS.

(Continued from page 206.*)*

To go into minute detail with reference to the various inventions which are now rivals in the contest for public favor, or to enter into any discussion of their relative merits, would comport neither with the objects of this report, nor with the strict impartiality which inventors have a right to demand from this office. A general notice of them is all that will be attempted.

The common syphon gauge or dynamometer is a tube of iron or glass, of equal calibre throughout, open at both ends, and bent in the shape of a U;—one limb being longer than the other, and the extremity of the shorter limb placed within the boiler. Into this tube mercury is introduced, and stands at an equal height in both limbs. When the pressure within the boiler is just equal to that of the atmosphere, the height of the mercury remains unchanged; but when the pressure within exceeds that of the atmosphere without, the mercury rises in the outer limb of the tube to a height proportioned to the difference—each inch of rise indicating an increased pressure within, equal to about one pound per square inch. When the tube is of iron, a float, placed on the surface of the mercury in the outer limb, is connected with a rod which passes out at the top and indicates the rise and fall on an attached scale. This instrument answers admirably as an indicator of pressure in low-pressure engines; but in those on the high-pressure principle (as about fifteen inches must be added to its length for each additional atmosphere of pressure), the great height to which the outer limb has to be carried renders its application inconvenient; nor is the serpentine form less objectionable. It, moreover, merely indicates pressure without giving an alarm, and is, therefore, no safeguard against explosion—except as offering to the eye of an attentive engineer an index of the existing force of the steam. Its bore is too small to permit it to act as an efficient means of escape for the steam, should the mercury be blown out by the excess of pressure within. While, therefore, it is a valuable appendage to a boiler, as an indicator of pressure, it cannot be considered as, of itself, a reliable security against danger.

The closed gauge or *manometer* is similar in general form to that just described; but its outer limb encloses air, and is not open to the external atmosphere. The air in this limb is condensed, and the indication of pressure within the boiler is given by the varying volume of the air in the outer limb;—the tube being transparent and graduated to atmospheres. The objections made to this gauge by the Franklin committee are, that it requires great nicety in its construction and graduation, and a correction for the temperature of the air enclosed in it. These objections were of sufficient weight to induce the declaration that no gauge applicable to it (the high-pressure boiler) has yet been brought into use,—a fact to which the attention of inventors should be called, as opening a field for the profitable and useful exercise of their ingenuity.

The glass water-gauge is a thick tube of well-annealed glass, connected with the boiler by two lateral pipes—one of which passes in below and the other above the proper level of the water. These pipes are provided with cocks, by which connexion between the tube and the boiler can be made at pleasure. The object of this apparatus is, to ascertain at a glance the true level of the water in the boiler. The objections which have been urged to its use are, that the unequal expansion of the glass and the metal with which it is connected renders the former liable to fracture; that it is also liable to fracture from shocks, and by sudden variations of temperature. To obviate these difficulties, it was proposed to pass the ends of the tube into stuffing-boxes, and to make them of well-annealed glass of considerable thickness. The use of green glass obviates the difficulty of the glass clouding, when high steam is used, from the action of the steam on the alkali contained in the substance of the glass. The indication by this instrument of the height of the water within the boiler was found to be accurate. Even when foaming occurred by relief of pressure within the boiler, and when the gauge-cocks could not be trusted, the oscillations in the tube did not amount to half an inch, and on closing the connecting pipes, the water in the tube became tranquil at the mean level of its oscillations. The use of this gauge is highly recommended by the Franklin committee.*

The *vaporimeter* of Mr. Quinby is an instrument intended to indicate the temperature of the steam within the boiler, by the expansion and contraction of mercury contained in a large metallic tube inserted into the boiler above the water level. It is, in fact, a large metallic thermometer, the bulb of which is the large tube within the boiler, and its stem the small perpendicular tube on the outside of it. On the mercury in this outer tube is placed a float, connected with a rod, the varying height of which indicates the temperature of the steam, and its consequent elasticity. Its advantages are, its little liability to injury from accident, and the ease with which its indications are read off, owing to the large size of the degrees marked upon its scale. It is, however, a mere indicator of temperature, and the consequent pressure, dependent for its utility upon the watchfulness of the engineer; and, therefore, least useful where danger, from his neglect, is greatest. Its cost is also a serious objection.

The *alarm altometer* of Mr. Quinby consists of a bucket float, enclosed in a cylinder, connected with the boiler by lateral pipes, entering below and above the water line, so that the water in the cylinder and in the boiler shall always stand at the same height. The fall of the float opens a small valve, to which a steam-whistle is attached. The operation of this instrument, as reported by Messrs. Johnson and Jones, was not satisfactory. The alarm was feeble, owing to the smallness of the valve; yet its size, if increased, would enable the pressure upon it, by highly elastic steam, to counteract the weight of the float, and thus prevent any action. It is also liable to obstruction from deposits, is too complex in its construction, and attains no object that could not be secured by a float within the boiler.

Another *altometer* has been invented by Mr. Quinby, which is a complex modification of the glass tube gauge, identical in principle, and offering no advantage over it. It is heavier than the common gauge, more liable to fracture, more difficult to repair, requires great precision in its workmanship, and is consequently very costly.

The *percussion water-gauge* of Worthington and Baker is an ingenious contrivance for ascertaining the height of water in the boiler by the percussive action of a horizontal flat surface brought suddenly into contact with the surface of the water, the height of which is to be gauged. It consists of a tube, so connected with the boiler as that the water it contains shall stand at the same height as that in the boiler. In this tube is a piston, which can be brought into sudden contact with the surface of the water by means of a projecting arm, under the control of the engineer. When it is desired to ascertain the height of the water, the engineer, by means of the arm mentioned, pushes down the piston until it strikes the water: the slight shock or concussion produced by the contact is readily felt by the hand of the engineer, and the position of the arm at the time gives, on an attached scale, the desired information. This instrument is said to operate well; but it depends entirely upon the attention of the engineer, and neither indicates the approach of danger nor relieves it. In the case of recklessness or neglect, it would be of no service.

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* The employment of these gauges was enforced by ordinance of the French government in 1830.

The common try-cocks are two or more tubes, entering the boiler at short distances above and below the due water line. When, upon turning the cocks, steam issues from the upper and water from the lower ones, the water in the boiler is supposed to be at its proper height. The indications of these instruments are, at least, extremely rude. When the water is above the highest, or below the lowest, they fail entirely; and when foaming occurs, no dependence can be placed upon them. In this case the error is most dangerous, as the indicated level of the water may be several inches above its true level. Notwithstanding the imperfection of these instruments, they are still employed to a very considerable extent, and their indications relied upon in determining so vital a question to the safety of all concerned as the height of water in the boiler.

The ordinary *safety-valve*, and contrivances which employ *fusible alloys*, are the chief devices embraced in the second class, or those which relieve the boiler from excess of steam by the force of pressure alone, or by temperature independent of pressure.

The *safety-valve* was introduced by Papin in his digester, was applied by Savery to his engine, and has ever since been relied upon as the principal means of relieving the boiler from excessive pressure. Its construction is too well known to need description. The two forms most commonly employed are the conical and disc-valves: the former, from the facility with which it can be tightened to prevent waste of steam, has been more generally employed than the latter. Its greater tendency, unless the cone be very obtuse, to become adherent to its seat, has been urged as a forcible objection to its use. The disc-valve is not so liable to this cause of danger, and is preferred by the Franklin committee. They adopted it in their experiments, and found that, when kept in fair working order, no adhesion took place.

But its liability to corrosion and adhesion are not the chief objections to the safety valve: when under the control of reckless men it may be, and there is abundant proof that it often is, loaded far beyond the highest estimated working pressure of the boiler. A boiler, moreover, may be burst by a force below its ordinary working pressure, when the tenacity of the metal has been diminished by heat; and in such a case, of course, the safety valve would have no tendency to relieve it. The evolution of steam, too, might be so sudden that the valve could not give it an exit sufficiently rapid to prevent explosion. The safety valve, then, though an indispensable appendage to the steam-boiler, is liable to these sources of failure, and therefore cannot be implicitly relied upon as a means of safety. It is lacking in some of the most essential of the qualities which have been pointed out as requisite in an apparatus which should satisfy the demand for perfect protection.

The *fusible plates* required to be attached to every boiler, by the ordinance of the French government, are plugs of an alloy so compounded as to melt, and so give vent to the steam, at a temperature corresponding with the greatest pressure under which the boilers are allowed to work. To prevent their giving way as they approach the fusing point, they are covered by wire gratings or perforated metallic discs. The experiments upon these plates, made by the Franklin committee, show that when fusible alloys are subjected to heat and pressure at the same time, the more fusible portions are melted first, and forced out by the pressure to which they are subjected. The residuary mass is thus left with a fusing point much above that at which the alloy was calculated to melt. Every repetition of the fusing process under these circumstances was attended with a rise of the temperature required to produce the result. It is evident that the protection afforded by fusible plates, used in this way, diminishes in proportion as the necessity for it is increasing by the deterioration of the boiler from age and use. The liability to this action has been considered a sufficient reason for deciding that no efficient practical application of these alloys can be made while they continue to be subjected to pressure.

To obviate this difficulty, Professor Bache devised the plan of enclosing the fusible metal in a tube inserted into the boiler, thus subjecting it to the action of temperature alone. The melting of the alloy in the bottom of this tube sets free a rod connected with an alarm apparatus, and, if necessary, with the safety valve. The same idea occurred, about the same time, to Mr. C. Evans, of Pittsburgh, Pennsylvania, whose safety guard is identical in principle with the device of Dr. Bache.

The *safety guard* of Mr. Evans consists of a tube inserted through the top of the boiler, with its bottom resting on one of the flues. A small quantity of fusible alloy is placed in the bottom of the tube, in which a spindle is inserted, so arranged as to be capable of turning only when the metal is in a state of fusion. On the upper end of this spindle is a small drum, around which a cord is wound. This cord passes over a pulley, attached to the end of the lever of the safety valve, and has fastened to it the weight which keeps the valve down. The operation is simple;—the alloy being melted, the spindle is as it were unsoldered, and allowed to turn; the cord is unwound from its drum; the weight falls on to a support prepared to receive it; and the safety valve is entirely relieved. The advantages of this plan are, that it not only indicates danger, but relieves it, and that the spindle is self-adjusting. The only operation requiring the attention of the engineer is the rewinding of the cord, an operation which could not be neglected without stopping the engine. The apparatus, however, is as liable to be tampered with as the common safety valve; it is acted upon by temperature alone, and would not indicate a deficiency of water, unless such deficiency were occasioned or accompanied by a rise of temperature sufficient to melt the alloy. The range of temperature in fusible alloys, between perfect fluidity and perfect hardness, is an important consideration with reference to the comparative sluggishness of the apparatus in which they are employed. The property most desirable in alloys, used in the safety apparatus of engines, is of course a small range of temperature in changing from the liquid to the solid state, as the promptness of the apparatus depends upon this quality. The Franklin committee found that, with reference to this range, those alloys should be preferred which contain the smallest quantities of lead, and, for the same reason, those containing the smallest proportions of bismuth.

The comparative sluggishness depends so much upon the particular composition of each alloy that no satisfactory general conclusion can perhaps be drawn from an average result. Alloys compounded to melt at high temperatures (where, of course, the necessity for promptness is greatest) have fortunately a less extensive range between fluidity and hardness than those intended to give way at low temperatures. The average result obtained by Professor Johnson, from experiments on one hundred and forty specimens, makes this range 31·1° Fahr.; so that when a mass of such alloy has become perfectly fluid, it requires that number of degrees of heat to be abstracted before it becomes again perfectly hard. This whole difference, however, is not operative in practice in the case of Evans' apparatus; for it was found, by the commission of 1843-4, that the average difference of temperature between fusing and setting is only about seven or eight degrees,—shewing that the action of the weight upon the spindle causes it to turn before the alloy has become perfectly fluid, and that the alloy is sufficiently set to support the weight before it has become perfectly hard. Still a range of seven or eight degrees in a boiler, under a pressure of five or six atmospheres, would require the pressure to be diminished from two to two and a half atmospheres, after the action of the apparatus, before it would be again ready to act. This diminution would be attended with a loss of both water and heat. The range of temperature between the opening and closing of a common safety valve, in ordinary working order, was found, in the same research, to be about 5°, shewing a difference in favor of the valve of about 3°. The comparison, however, is not intended to be carried further than this single point. The fusing point of the alloy does not change materially by the repetition of the melting process. On the whole, Mr. Evans' apparatus (when the alloy is properly prepared, the apparatus fairly used, and not tampered with) is one upon which considerable reliance may be placed for the purpose which it professes to accomplish—the indication and relief of a dangerous elevation of temperature in the metal of the boiler.

The *expansion guard* of Mr. Wright makes use of the different expansibility of metals as an indication of the temperature of the boiler, and a means of relieving the safety valve, where the elevation of temperature is such as to indicate a dangerous increase of pressure. A brass tube, closed at its inner end, is inserted into the boiler head, immediately over one of the flues. In this tube, but lying loosely, and attached only to its inner end, is a rod of iron, projecting on the outside a short distance beyond the head of the boiler. When the brass tube is heated, it expands, and of course projects further into the boiler, carrying with it the less expansible iron rod. The outer end of this rod moves an index, which shews the temperature of the metals, and is attached to a catch which operates to relieve the safety valve, as soon as a dangerous pressure on the boiler is indicated by the temperature attained.

With regard to all self-acting apparatus, intended to relieve the safety valve, it ought to be borne in mind that their operation is attended with a consequence which might, under some circumstances, prove a very serious disadvantage. It is, that the boat may be deserted by its power at the moment of greatest need. In going through such a passage as Hell Gate, for instance, such a desertion, even if but momentary, might be attended with fatal results. This view would seem to justify a preference for apparatus intended to give an alarm, over those which operate spontaneously to relieve the safety valve. Where engineers are careful, there can be little doubt of the propriety of such a preference.

The third class of safety apparatus includes such as act by deficiency of water, combined with the pressure, to relieve from the dangerous tension of steam.

The *double acting safety valve* of Mr. Raub differs from the ordinary safety valve in having a float and additional lever attached to it, so arranged that the fall of the float below the proper waterline opens first a small valve, to sound an alarm, and, if the fall continues, raises the main safety valve. The small valve opens downwards, and it was found that, in boilers using high steam, the pressure was sufficient to keep it closed,—thus reducing the apparatus to the common safety valve, "to which," in the opinion of the board to whom it was submitted, "it is in no respect superior."

The *hydrostatic safety apparatus* of Mr. Duff is a valve with a large hollow head, from which a tube passes down below the ordinary level of the water in the boiler to the lowest permissible water line. So long as the mouth of the tube remains below the water, the valve head is kept full of water, which thus forms the greater part of the load; but when the water in the boiler falls below the mouth of the tube, that in the valve head is, of course, discharged into the boiler,—thus relieving the valve of its load. The time taken to discharge the water from the valve head renders the operation of this apparatus sluggish; and as it is liable to be brought into action by any sudden change of level in the water, though such change may be unattended with danger, it is not considered applicable to the boilers of steam-boats.

The *interior safety valve* of Mr. Easton is placed, as its name imports, entirely within the boiler, and is not liable to be tampered with by the engineer while the boat is in motion. The valve opens downwards, and is kept closed by a lever of the first order. There is a float attached, the fall of which raises the long arm of the lever and opens the valve. A rod (called a *feeler*), passing through the top of the boiler immediately over the valve, enables the engineer to open but not to close it. The valve was found, upon experiment, to open promptly;—the mean difference between the opening and closing pressure being only 5·32 pounds. This apparatus, however, does not indicate whether the escape of steam is due to the fall of the water in the boiler, or to a pressure beyond its load. This may be ascertained, however, by raising another valve, when, if the opening of the interior valve be caused by excessive pressure, it will at once close, but if from deficiency of water, it will continue to blow. Mr. Easton's apparatus is favorably spoken of by the board by whom it was examined. It was tried by them, however, under favorable circumstances, and with pure water. Its efficiency on the muddy waters of the west, this office has no means of ascertaining.

The several forms of apparatus for supplying water, without indicating either temperature or pressure, constitute the fourth and last class.

The instrument for this purpose, ordinarily employed, is the common force-pump, worked by the engine. Its liability to obstruction, and the fact that it operates only while the engine is in motion, constitute the chief objections to it. Many boats employ subsidiary pumping engines, which supply water during the stoppage of the main engine.

The self-acting pumping apparatus of Mr. Barnum is brought into action by a float, the fall of which below the due water line opens a valve, which supplies steam to a subsidiary pumping engine. A deficiency of water sets the pump in action, without the agency of the engineer, and a full supply stops it. An ingenious double valve has been applied to it, which prevents the pressure of the steam from counteracting the weight of the float;—thus rendering it applicable to high as well as low-pressure boilers. The trials made by the board of examiners with this apparatus were in general highly satisfactory.

Having thus glanced at a few of the more prominent mechanical devices for the prevention of explosions, some of which claim to be important improvements upon the safety apparatus of the steam-engine, the undersigned does not feel called upon to express any opinion as to their relative merits, still less to point out any particular apparatus as best calculated to meet the wants of the public. Even if any one of these contrivances could be singled out with certainty as the best existing plan for obviating danger of explosion, it is not believed that its employment ought to be recommended as the subject of compulsory legislation by Congress. These plans are all before the public, who have a vital interest in selecting the one best calculated to secure their lives and property. Nothing can add to the force of motives drawn from the love of money and the desire of self-preservation. If the apparatus selected for government protection were not the best, the law would be evaded, or openly disobeyed; if it were the best, and yet not a perfect safeguard, its protection would operate as a check upon the ingenuity of inventors, by taking away its strongest stimulus. The source of danger, in the opinion of the undersigned, is to be looked for elsewhere than in the imperfection of the engine or its appendages, and the legislative remedy ought to be applied in a different quarter.

The legal remedies for explosions, then, are the next subject to be considered. These are either preventive or penal. The preventive measures are such as relate to the qualities of the engine, and the qualifications of those who are to inspect or manage it. The penal provisions are those which provide for actions, civil or criminal, against the parties through whose fault injury has been committed.

Before submitting any suggestions or recommendations, "with reference to further legislation by Congress for the prevention of the explosion of steam-boilers," it is deemed proper to lay before the Senate the objections which are entertained by practical men to the existing laws, together with the modifications of them which they propose.

The laws now in force are those of July 7, 1838, and March 3, 1843. The third section of the law of 1838, gives to the "district judge of the United States, within whose district any ports of entry or delivery may be," the appointment of inspectors, to make inspections of the hulls, boilers, and machinery of "vessels propelled in whole or in part by steam."

It is objected to this provision that the district judge is not likely, from the character of his pursuits and associations, to be able to form a very correct estimate of the qualifications of applicants for the office. In some cases his residence is remote from the port where the duties of the inspectors are to be performed, which renders it improbable that he could have any personal knowledge of the character of applicants, or be able to exercise over them any supervision. It is therefore proposed to place the appointing power in the hands of a resident, or residents, of the port where the inspections are to be made, and with individuals, the character of whose pursuits is calculated to render them competent judges of the qualifications of the applicants for the place of inspector.

Again, this section makes no provision for a separation of the duties of inspecting hulls, and inspecting boilers and machinery; but renders any inspector competent to perform both. The qualifications necessary to perform one of these inspections are quite different from those requisite to perform the other. The inspector of hulls should be a man well acquainted with boat-building; whereas the inspector of boilers and machinery should be a sound practical engineer. The union of both these offices in the person of each inspector, renders it almost certain that one of the duties will be ill-performed, and gives rise to a rivalry and competition in the highest degree prejudicial to the character of the inspection; for there is but one voice as to the existence of the fact that steamboat owners and captains will always employ in preference the inspector who is least faithful in the performance of his duty. By dividing the offices, and thus taking away competition, the inspector would be more independent, and more likely to make his inspection thorough. This end would be still further secured by requiring that all boats in a certain trade should be inspected at a certain port;—thus limiting each boat to a single inspector.

A recommendation which contemplates the examination of inspectors by a board, consisting of the best practical engineers, has been made with great unanimity by all who have proposed modifications of the law. It is also proposed that the same board should decide on the qualifications of engineers, who should not be allowed to hold the office without a certificate from the board of examiners; nor should boat owners or captains be permitted to employ engineers without such certificate.

The elevation of the character and standing of the engineer becomes, in the views of the subject taken in the former part of the report, a matter of primary importance to the safety of the public. It is a fixed principle of human nature that men become worthy of confidence and respect in proportion as they feel themselves to be respected. Services which are deemed worthy of the special notice of the law, which are well paid, and to perform which a man must go through a course of preparatory training, and submit to a rigid and impartial examination, assume, in his eyes, an importance which they cannot have when he receives his appointment without enquiry as to his qualifications, and is left to perform its duties as he may. In the former case, the right performance of duty becomes a point of professional pride; in the latter, it sinks to a mere question of pay. The unanimity with which the recommendation above alluded to has been made, of a board of examiners before whom all candidates for inspectorship, or the office of engineer, should be required to pass, before obtaining the office sought, entitles it to respectful consideration. In relation to another department, where the health and life of individuals are placed under the professional care of medical men, the government has acted upon the plan here recommended. The evidence of having received a medical education, and the diploma of the most eminent medical school, are not considered a sufficient guarantee. The candidate for a medical appointment, in either arm of our military service, must pass a searching examination, by an able board of examiners, as to his knowledge of the theoretical and practical parts of his profession; yet the number of lives dependent upon the skill and care of any one of these officers is not for a moment to be compared with those that hang upon the doubtful competency of an inspector of steam-boilers or a steam-boat engineer. The ignorance of the former may send men to their graves *singulatim* and by retail; but one act of carelessness in the latter may cause the instant destruction of hundreds. If the magnitude of the interest at stake is a sufficient reason for the examination in the one case, it is *a fortiori* a reason in the other. Faithfully administered, there can be little doubt that such a system would tend to give new dignity to the employment, by establishing a higher standard of qualification.

The fourth section of the law prescribes the duties of the inspector of hulls, and regulates his fees. The inspection of hulls, by a government officer, is thought unnecessary, inasmuch as the insurance offices, which have a deep stake in the security of the vessel, have competent inspectors, appointed by themselves, whose examination, it appears, is much more rigid than that of the government inspectors; and it is said to be no uncommon case for a boat to be condemned by the insurance office inspector which had just received the certificate of the United States officer. It is urged, moreover, with some force, that vessels which navigate the ocean, the soundness of whose hulls is a matter of much greater consequence to the safety of the travelling world than that of the hulls of steam-boats, are not burdened with this tax, but left to the exclusive care of the insurance inspectors. It is proposed, as an additional amendment to this section, that the inspectors should be paid by the government.

By the fifth section of the law, the inspectors are required to make a certificate as to the soundness of the boilers, and to furnish the master or owner of the boat with a duplicate of the same. If the inspection, as at present conducted, be, as it is represented, a useless tax upon boat owners, and of no value as a guaranty of the safe condition of the boilers, the certificate can only serve to beget a false, perhaps a fatal, confidence in the minds of the passengers. Such is the opinion expressed by the Cincinnati association of engineers. Before the certificate can be of any value, the course to be pursued in the inspection must be plainly laid down, and some exact standard of thickness, strength, &c., be adopted, below which no boilers should be suffered to fall without a denial of the certificate.

The intervals at which inspections of hulls and boilers are to be respectively performed, are regulated by the sixth section of the law. The fact, well ascertained, that the strength of boilers may be so impaired by the misusage of a single trip as to be utterly unsafe, would seem to be a sufficient objection to such a limitation; and yet to subject the owners to frequent inspections, at a heavy cost, and which may possibly be, in most cases, unnecessary, appears to be a measure unwarrantably oppressive, and which would operate most severely upon those who were most worthy of public confidence. Some have gone so far as to recommend the monthly application of the hydrostatic test. To secure the benefit of frequent inspections, while their oppressiveness to owners should be avoided, it has been suggested that the inspectors should receive from the boat their fees for the semi-annual examination, and, in addition, a small salary from the government, in consideration of which it shall be their duty to visit and inspect, without unnecessary delay, each boat that arrives at the port.

The seventh section requires the safety-valve to be opened when the vessel stops for any purpose whatever, under a penalty of two hundred dollars. Such a provision must have arisen from a misapprehension of the consequences that may arise from the adoption of a fixed rule with regard to the opening of the safety-valve. If the views advanced in the former part of this report, as to the causes of explosions be correct, the opening of the valve at a stopping place might, under some circumstances, be the cause of the very accident it was intended to prevent. If the water were low, and the top of the flues overheated, the opening of the valve, causing a violent ebullition or "frothing," would throw the water into contact with the over-heated metal,—thus suddenly generating a quantity of highly elastic steam, to which the valve could not afford a sufficiently rapid exit, and an explosion would be the necessary consequence. Measures tending to elevate the character of the engineer, and render him more careful and trustworthy, would do away with the necessity for any such interference with the minor regulation of the engine.

The penalties provided in the twelfth section of the law are regarded as too harsh, and it is found that, on that account, they cannot be enforced. Juries cannot be induced to subject a man to the penalties of manslaughter for an act of negligence to which they find it impossible to attach the degree of guilt which so severe a sentence would seem to imply.

The thirteenth section makes the fact of the explosion *prima facie* evidence of negligence, in all suits or actions against proprietors of steam-boats for injuries arising to person or property from the bursting of the boiler, &c. This provision, it is urged, raises an adverse presumption upon a fact which it is impossible to deny, and throws upon the defendant the necessity of proving a negative, a task always difficult, and rendered peculiarly so by the circumstances of terror and excitement which always attend these events. The severity of this feature of the law is said to have driven many worthy and enterprising steam-boat proprietors from the business, and left it in hands less responsible.

The law of 1843 has exclusive reference to the steering apparatus of "vessels propelled by steam," and therefore has no bearing upon the subject of this report.

Such, then, are some of the objections to the existing law which have been advanced by men who have had the best opportunities of witnessing its practical working. Though it can scarcely be denied that they are, in the main, well founded, yet the undersigned is not prepared to recommend the remedies which are suggested. He is convinced, by as thorough an examination of this subject as his time and the means of information in his possession would permit, that, by descending to the details of management in matters of which it cannot be the best judge, the law subjects itself to the charge of oppression, or lays itself open to contempt. If constructors and engineers could be made competent and careful, there would be no necessity for minute directions; and where they are not so, no legislation can protect the public against the consequences of their misconduct. For it is not to be supposed that a man, who would neglect his duty at the risk of his life, could be induced to perform it by any motives the law could bring to bear upon him.

It is the deliberate opinion of the undersigned, that the best remedy for all the evils complained of would be to make a strong appeal to the interests of boat-masters and proprietors, by giving a remedy, where explosions result in injury to persons or property, to the individuals wounded, or to the nearest relative or friend of the killed, in the shape of heavy damages, recoverable by action at law. And the undersigned would recommend that, in addition to the personal responsibility of the owners, the boat itself should be held by way of *lien* to respond the damages which may be recovered by the plaintiff; and that, in case the owner is an incorporated company, the members of the company should be held severally as well as jointly liable in their individual capacities. Such a course would bring the most powerful motive to bear to force the proprietors to employ, in the construction of boats, the best materials and the most skilful and faithful workmen, and to entrust their management to those engineers alone who can bring the most satisfactory evidence of their competency, carefulness, and good character. Properly constructed, the steam-engine is believed to be as free from defects as most human contrivances; and, under careful and intelligent management, as free from danger as the nature of the powerful agent it is intended to control can allow us reasonably to expect.

In expressing these views, the undersigned would not be understood as intending to undervalue or discourage the exercise of ingenuity in the multiplication of the means of security, or those investigations of science which tend to develope the *natural causes* upon which these lamentable occurrences may depend. On the contrary, he is convinced that the government cannot more legitimately exercise an enlightened care over the safety of the people than by fostering such ingenuity, and promoting such investigations by providing the means for their prosecution.

The peculiar circumstances of Western steam navigation seem to make it a subject worthy of special attention. The fact that disasters seem, in a great measure, to have ceased in all parts of the country, except on the Mississippi and its tributaries, renders it probable that there are causes in operation on those waters which do not exist elsewhere, and which deserve investigation. One of these causes may be found in the quantity and peculiar nature of the deposits from the turbid water of those streams. From a report made to the American Association for the advancement of science, in September, 1848, it appears that of the whole mass of water passing down the Mississippi, when examined near Natchez, not less than one part in every 528 is solid matter, capable of being deposited by simple repose. How much more would have been deposited had the water experimented on been evaporated to dryness, or in other words, how much solid matter was in a state of chemical solution, has not yet been determined. That the quantity thus held in solution is very considerable, is rendered probable from the known fact that the waters of the Ohio at least give incrustations to evaporating vessels, even when no turbidness or mechanically suspended matter exists in it. It is also known to possess the quality of "hardness," as proved when tested by the usual re-agents.

The exact nature of these sediments has not yet been ascertained, but seems eminently worthy of a careful determination. Their bearing upon the question of efficiency of the safety apparatus is frequently alluded to in the report of the Board of Examiners of 1844, so often referred to; but the investigation, not being contemplated by their appointment, was not gone into. The utility of such an investigation will be apparent from the fact, before alluded to, that, in the case of sea-going steamers, it has led to the discovery of the nature of some of these incrustations, and the application of a solvent.

The same minute and searching enquiries which have been instituted with regard to the strength of materials for boilers, the causes of explosions, and their remedies, and the numerous incidental questions hitherto examined under public authority, if applied to the peculiar circumstances of Western navigation, would undoubtedly tend to develope the causes and suggest remedies for the evils which still exist in connexion with that important branch of our internal trade. Many points of the subject would suggest themselves to the scientific minds, to which it should be referred—minds competent to detect by observation, and develope by experiment, the difficulties in which it is involved.

I have thus, as far as the means of information in my possession permitted, complied with the requisition of the Senate. In doing so, free use has been made of the latest and best authorities on the subject of boiler explosions; and it is believed that full credit is given wherever such sources have been resorted to. The labors of the Franklin Institute committee have been considered as the most valuable additions to the amount of our knowledge on the subject, and they have therefore been largely quoted. It is a subject of regret that so little that is new in relation to the causes and the means of prevention of explosions could be submitted for your consideration. The accounts given in the returns go so little into detail, and are marked by so many important omissions, that any satisfactory generalizations from them were rendered almost impossible. But the undersigned is of opinion that, though the present report may throw no new light on the subject, yet the service of presenting, in one condensed general view, a *resumè* of the present state of knowledge in relation to this subject, in a form intelligible to the general reader, may be one of some value in its bearing upon intelligent legislation, and as affording a useful source of information to the practical men, perhaps deficient in scientific knowledge, into whose hands this report may possibly fall.

The main points of this enquiry seem to have been exhausted by the very able report of the committee of the Franklin Institute. Their investigations may be considered as having settled most of the questions to which their attention was directed. There still remain, however, some points not fully determined by that committee, and which have already been alluded to in this report, but which may well be recapitulated here. They are:—1st. As to the extent to which a local relief of pressure would operate to produce a difference of level in the water in a boiler; and whether an explosion could result from such difference. 2nd. A more full investigation of the repulsion between water and metals heated to a certain temperature. 3rd. The whole subject of incrustations is yet comparatively open as a field for investigation.

On these points the undersigned takes the liberty of suggesting the institution of an investigation, to be made at the expense of the government, and conducted, as were the valuable labors of the Franklin committee, under the auspices of some recognized scientific association. On the subject of deposits, these experiments should extend to the sediments of all the principal rivers navigated by steam in our country. Aside from their relation to the subject now under consideration, the geological results of such an investigation could not fail to be of great interest and value.

I have the honor to be, very respectfully,

Your obedient Servant,

EDMUND BURKE,
Commissioner of Patents.

e Hon. GEO. M. DALLAS,
esident of the United States, and
President of the Senate.

LIST OF REGISTRATIONS EFFECTED UNDER THE ACT FOR PROTECTING NEW AND ORIGINAL DESIGNS FOR ARTICLES OF UTILITY.

1849.

Oct. 1. *John Gray*, of Edinburgh, N. B., for a gravy-dish.

1. *William Frederick Padwick*, of the Manor House, Hayling Island, Southampton, for a garden-drill.

1. *Gray & Keene*, of Strand-street, Liverpool, for an aural log-timer.

1. *John Beux Winder*, of Birmingham, for an envelope.

3. *Josiah Human*, of March, Cambridgeshire, civil engineer, for a water-elevator.

4. *John Morland & Son*, of 50, Eastcheap, London, for the "floriform parasol."

5. *Walter Morgan*, of 7, Boundary-place, in the Borough of Liverpool, in the county of Lancaster, for a wire-fastened circular brush, for cleaning boilers and other tubes.

5. *Isaac Green*, of 3, Vittoria-place, Euston-square, for an improved wind-guard.

6. *George Alexander Copeland*, of Pendennis Castle, New Falmouth, Cornwall, for a safety cartridge, for blasting purposes in mines, quarries, and other situations.

8. *John Hynam*, of 6 and 7, Princes-square, Wilson-street, Finsbury, London, chemical light manufacturer, for a metal box, with rounded corners at ends and bottom, to be opened by an horizontal groove-slide (inverted).

8. *William Gray, Charles Christopher, & Thomas Barratt*, of Neptune-street, Liverpool, ship-smiths and braziers, for an improved cooking apparatus for ships.

8. *James Townsend*, of Birmingham, for an improvement on, or addition to, valves for air-guns.

10. *W. Thickthener*, of 4, Union-terrace, Bagnigge-wells-road, Clerkenwell, chronometer, watch, and clock-maker, for a solid impulse lever.

13. *William Tranter*, of 13, St. Mary's-square, Birmingham, for a lever-catch for pistol locks.

13. *A. Beldham & Co.*, of Portsea, for the "Roman Toga."

15. *Oliver & Co.*, of 210, Regent-street, for a graduated plug flower-pot.

15. *Edward Burgess & Thomas Hewetson*, of 8, Robert-street, Bedford-row, for a thermomotive-spring.

Oct. 16. *Brown, Lenox, & Co.*, of Billiter-square and Millwall, for an instrument for retaining the links of flat chain in position.

17. *Charles Minifie*, of 36, College-green, Bristol, for a shirt.

17. *Charles C. B. Williams & Co.*, of Old Montague-street, Whitechapel, for the "family safeguard match-box."

18. *William Bridges Adams*, of Fair Field Works, Bow, Middlesex, for part of a railway wagon.

18. *How & Dudgeon*, of Stepney, for a domestic filter.

18. *William & Richard Suggitt*, of Silver-street, Manchester, machine makers, for a power-driving motion for a warping mill.

19. *Joseph Harrison*, of Blackburn, Lancashire, machine-maker, for headle apparatus for looms.

19. *Joseph Harrison*, of Blackburn, Lancashire, machine-maker, for headle apparatus for looms.

20. *John Ridgway*, of Cauldon Place, Staffordshire, for a bason of a water-closet, the exterior and cover being so formed as not to require any exterior cover or seat.

22. *Alexander Grant & Brothers*, of Clement's-court, Wood-street, Cheapside, London, for a stretcher and rib-joint for umbrellas and parasols.

23. *James Rogers*, of Yately, Hants, for a ventilating brick.

24. *Richard Adams Ford*, of 185, Strand, Middlesex, shirt maker and hosier, for a fastening of a shirt collar.

24. *G. Erby*, of 294, Oxford-street, London, for the "Oxford shirt and collar band."

24. *John Harrop*, of Sheffield, builder, for the "inodorous commode pan."

25. *Henry & Robert Smith*, of the firm of Tymothy Smith & Sons, of the brass foundry, Bartholomew-street, Birmingham, for a deflective-plate gas-burner.

List of Patents

That have passed the Great Seal of IRELAND, from the 17th September to the 17th October, 1849, inclusive.

To George Nasmyth, of Great George-street, Westminster, civil engineer, for certain improvements in the construction of fire-proof flooring and roofing; which improvements are applicable to the construction of viaducts, aqueducts, and culverts.—Sealed 18th September.

James Warren, of Montague-terrace, Mile-End-road, in the county of Middlesex, Gent., and Willoughby Theobald Monzani, of St. James's-terrace, Bermondsey, in the county of Surrey, Gent., for improvements in the construction of bridges, viaducts, and aqueducts, and in anchors, and in drilling and boring braces. —Sealed 27th September.

Robert Plummer, of the town and county of Newcastle-on-Tyne, manufacturer, for certain improvements in machinery, instruments, and processes employed in the preparation and manufacture of flax and other fibrous materials.—Sealed 1st October.

John Holland, of Larkhall Rise, in the parish of Clapham, in the county of Surrey, Gent., for a new mode of making steel,—being a foreign communication.—Sealed 6th October.

List of Patents

Granted for SCOTLAND, subsequent to September 22nd, 1849.

To William Parkinson; of Cottage-lane, City-road, London, gas-meter manufacturer, for improvements in gas and water meters, and in instruments for regulating the flow of fluids.—Sealed 24th September.

John Mason, of Rochdale, machine-maker, and George Collier, of Barnsley, manager, for certain improvements in machinery or apparatus for preparing and spinning cotton and other fibrous materials; and also improvements in the preparation of yarns or threads, and in the machinery or apparatus for weaving the same.—Sealed 24th September.

James Aitken, of Cook-street, Glasgow, for certain improvements in the preparation of cotton and other yarns for weaving, and in the machinery employed therein.—Sealed 27th September.

John Robinson, of Patterson-street, Stepney, London, engineer, for improvements in machinery for moving and raising weights. —Sealed 3rd October.

Ernest Grassel, of Birmingham, for improvements in apparatus for the preservation of human life, and in moulding, forming, and finishing hollow and' solid figures, composed wholly or in part of certain gum or combination of certain gums; also improvements in dissolving the aforesaid gums, and in apparatus or machinery to be used for the purposes above mentioned.—Sealed 8th October.

Robert Clegg, Joseph Henderson, and James Calvert, of Blackburn, manufacturers, for certain improvements in looms for weaving.—Sealed 8th October.

William Gaspard Brandt, of No. 16, Compton-street, Brunswick-square, London, machinist, for improvements in the construction of the bearings of railway engines, and railway and other carriages now in use.—Sealed 11th October.

Thomas Lightfoot, of Broad Oak, within Acrington, county of Lancaster, chemist, for an improvement in printing cotton fabrics.—Sealed 11th October.

Thomas Beale Browne, of Hampen, county of Gloucester, Gent., for certain improvements in looms, and in the manufacture of woven and twisted fabrics,—being a communication.—Sealed 15th October.

George Henry Dodge, of the United States of America, but now residing at Manchester, for certain improvements in machinery for spinning and doubling cotton yarns and other fibrous materials; and in machinery or apparatus for winding, reeling, balling, and spooling such substances when spun.—Sealed 15th October.

Charles Shepherd and Charles Shepherd, jun., both of Leadenhall-street, London, chronometer-makers, for certain improvements in working clocks and other time-keepers, telegraphs, and machinery, by electricity.—Sealed 15th October.

George Park Macindoe, residing at Mountblow, Old Kilpatrick, Dumbartonshire, for certain improvements in machinery or apparatus applicable to the preparation, spinning, and doubling or twisting of cotton, wool, silk, flax, and other fibrous substances.—Sealed 19th October.

Joseph Stovel, of Suffolk-place, Pall Mall East, London, tailor, for improvements in coats; parts of which improvements are applicable to sleeves of other garments.—Sealed 19th October.

David Christie, of St. John's-place, Broughton-lane, Salford, merchant, for welding and uniting cast-iron with steel and malleable iron,—being a communication.—Sealed 19th October.

Frederick William Norton, of Lascelles Hall, Lepton, parish of Kirkheaton, Yorkshire, for improvements in manufacturing plain and figured fabrics.—Sealed 19th October.

John Coombe, of Leeds, civil engineer, for improvements in machinery for heckling, carding, winding, dressing, and weaving flax, cotton, silk, and other fibrous substances.—Sealed 22nd October.

New Patents

SEALED IN ENGLAND.

A grant unto James Higgins, of Salford, in the county of Lancaster, machine-maker, and Thomas Schofield Whitworth, of Salford aforesaid, mechanic, for certain improvements in machinery for preparing, spinning, and doubling cotton, wool, flax, silk, and similar fibrous materials.* Sealed 24th September—6 months for inrolment.

William Jamieson, of Ashton-under-Lyne, in the county of Lancaster, machine-maker, for certain improvements in looms for weaving. Sealed 4th October—6 months for inrolment.

Charles Attwood, of Tow Law Iron Works, near Darlington, in the county of Durham, Esq., for an improvement or improvements in the manufacture of iron. Sealed 5th October—6 months for inrolment.

William Edward Newton, of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, civil engineer, for improvements in machinery for planing, tongueing, and grooving boards or planks,—being a communication. Sealed 5th October—6 months for inrolment.

Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, mechanical draughtsman, for improvements in the manufacture of pipes or tubes,—being a communication. Sealed 5th October—6 months for inrolment.

Henry Watson, of the town of Newcastle-upon-Tyne, brass-founder, for improvements in valves and cocks. Sealed 12th October—6 months for inrolment.

Robert Lakin, of Ardwick, in the county of Lancaster, machinist, and William Henry Rhodes, of Openshaw, in the county of Lancaster, mechanic, for certain improvements in machinery used for preparing, spinning, doubling, and weaving cotton and other fibrous substances. Sealed 12th October—6 months for inrolment.

Pierre Armand le Comte de Fontainemoreau, of South-street, Finsbury, for improvements in spinning fibrous substances,—being a communication. Sealed 12th October—6 months for inrolment.

Joseph Lowe, of Salford, in the county of Lancaster, surveyor, for certain improvements in grates or grids, applicable to sewers, drains, and other similar purposes. Sealed 12th October—6 months for inrolment.

Michael Fitch, of Chelmsford, in the county of Essex, patent salt manufacturer, for improvements in baking bread, biscuits, and other matters; which improvements are applicable for drying goods. Sealed 12th October—6 months for inrolment.

Cornelius Bonell, of Kempsey, in the county of Worcester, engineer, for certain improvements in rotatory engines to be worked by steam or other means; and also in the construction of carriages, vessels, or other vehicles to be worked or propelled by the said improvements in rotatory engines or other motive power; and for the machinery to be connected therewith. Sealed 12th October—6 months for inrolment.

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* This patent, being opposed by caveat at the Great Seal, was not sealed till the 2nd October, but bears date the 24th September, the day it would have been sealed had no opposition been entered.

James Banister, of Birmingham, manufacturer, for a certain improvement or certain improvements in tubes for locomotive and other boilers. Sealed 12th October—6 months for inrolment.

George Alois Ringeisen, of Essex-street, Strand, chemist, for a composition or preparation for destroying vermin. Sealed 12th October—6 months for inrolment.

Charles Rowley, of Newhall-street, Birmingham, button manufacturer, for certain improvements in apparatus for weaving, and in articles to be attached to dresses. Sealed 12th October—6 months for inrolment.

John Torkington, of Bury, in the county of Lancaster, railway contractor, for certain improvements in the construction of chairs for railways.—Sealed 12th October—6 months for inrolment.

John Christophers, of Heavitree, in the county of Devon, merchant and ship-owner, for improvements in naval architecture. —Sealed 12th October—6 months for inrolment.

Thomas Lightfoot, of Broad Oak, within Accrington, in the county of Lancaster, chemist, for improvements in printing cotton fabrics. Sealed 12th October—6 months for inrolment.

William Stedman Gillett, of Wilton-street, Grôsvenor-place, Esq., for improvements in packing pistons, stuffing-boxes, slides, and other parts of machinery, and in forming bearings; and in making cylinders and other forms of metal.—Sealed 12th October—6 months for inrolment.

Conrad William Finzel, of the city and county of Bristol, sugar refiner, for improvements in the processes and machinery employed in and applicable to the manufacture of sugar. Sealed 12th October—6 months for inrolment.

John Mercer, of Oakenshaw, in the county of Lancaster, Gent., and William Blythe, of Holland Bank, Oswoldtwistle, in the same county, manufacturing chemist, for improvements in certain materials to be used in the processes of dyeing and printing. Sealed 12th October—6 months for inrolment.

Jules le Bastier, of Paris, Gent., for certain improvements in machinery or apparatus for printing. Sealed 12th October—6 months for inrolment.

Joseph Johnson, of Huddersfield, in the county of York, bricklayer, and Joe Cliffe, of the same place, iron founder, for improvements in furnaces, or in the means of consuming smoke. Sealed 12th October—6 months for inrolment.

John Debell Tuckett, of Plymouth, in the county of Devon, merchant, for a new and improved method of preparing a manure called superphosphate of lime, without using any acids in the decomposition of the various substances of which the manures now in use, and for which patents have been obtained, called superphosphate of lime, by the application of artificial agency, by which more than double the quantity of a true superphosphate of lime can be produced beyond that for which any patent has hitherto been granted, that the same may be applied in the production of all kind of crops,—more particularly wheat, barley, oats, turnips, and other vegetables. Sealed 18th October—2 months for inrolment.

Thomas Dawson, of Melton-street, Euston-square, machinist, for improvements in cutting and shaping garments and other articles of dress for the human body. Sealed 18th October—6 months for inrolment.

George Shove, of Deptford, in the county of Kent, for improvements in manufacturing ornamented surfaces when glass and other substances are used,—being a communication. Sealed 18th October—6 months for inrolment.

Joseph Stovel, of Suffolk-place, Pall Mall, in the county of Middlesex, tailor, for improvements in coats; part of which improvements are applicable to sleeves of other garments. Sealed 18th October—6 months for inrolment.

David Hulett, of Holborn, in the county of Middlesex, gas engineer, and John Birch Paddon, of Lambeth, gas engineer, for improvements in gas-meters, and in gas regulators. Sealed 18th October—6 months for inrolment.

Ethan Campbell, of the City of New York, in the United States of America, philosophical, practical, and experimental engineer, and a citizen of the said United States, for certain new and useful improvements in the means of generating and applying motive power, and in propelling vessels. Sealed 18th October—6 months for inrolment.

William Wyatt, of Waterloo Cottage, Oldswinford, in the county of Worcester, pump-maker, for improvements in coating the surfaces of pumps, pipes, cisterns, and other articles of iron. Sealed 18th October—6 months for inrolment.

Charles Felton Kirkman, of Argyle-street, in the county of Middlesex, Gent., for certain improvements in machinery for spinning or twisting cotton, wool, or other fibrous substances. Sealed 18th October—6 months for inrolment.

CELESTIAL PHENOMENA FOR NOVEMBER, 1849.

D.	H.	M.	
1			Clock after the ☉ 16m. 16s.
	—		☽ rises 5h. 37m. A.
	—		☽ passes mer. 0h. 6m. A.
	—		☽ sets 7h. 32m. M.
	19	12	☿ stationary
2	11	0	☽ in Perigee
3	15	34	♃'s first sat. will im.
4	3	10	♂ in conj. with the ☽ diff. of dec. 5. 10. N.
5			Clock after the ☉ 16m. 4s.
	—		☽ rises 9h. 7m. A.
	—		☽ passes mer. 4h. 2m. M.
	—		☽ sets 11h. 59m. M.
	—		Occul. 3 Cancri, im. 11h. 45m. em. 12h. 25m.
6	13	37	♃'s second sat. will im.
7	8	23	☽ in □ or last quarter
8	16	6	♂ stationary
9	4	37	☿ greatest elong. 19. 1. W.
	7	7	♃ in conj. with the ☽ diff. of dec. 0. 33. S.
10			Clock after the ☉ 12m. 58s.
	—		☽ rises Morn.
	—		☽ passes mer. 7h. 5m. M.
	—		☽ sets 2h. 46m. A.
	17	28	♃'s first sat. will im.
10	17	6	☿ greatest hel. lat. N.
11	15	2	♀ greatest hel. lat. N.
	23	59	♀ in conj. with the ☽ diff. of dec. 2. 31. S.
	—		Occul. 66 Virginis, im. 15h. 40m. em. 16h. 29m.
12	16	29	☿ in conj. with the ☽ diff. of dec. 2. 21. S.
13			Mercury R. A. 14h. 9m. dec. 10. 18. S.
	—		Venus R. A. 13h. 34m. dec. 8. 5. S.
	—		Mars R. A. 6h. 26m. dec. 24. 49. N.
	—		Vesta R. A. 7h. 55m. dec. 19. 38. N.
	—		Juno R. A. 12h. 28m. dec. 2. 30. S.
	—		Pallas R. A. 18h. 25m. dec. 3. 25. N.
	—		Ceres R. A. 19h. 15m. dec. 28. 35. S.
	—		Jupiter R. A. 11h. 19m. dec. 5. 28. N.
	—		Saturn R. A. 0h. 9m. dec. 1. 44. S.
	—		Georg. R. A. 1h. 27m. dec. 8. 29. N.
	—		Mercury passes mer. 22h. 35m.

D.	H.	M.	
13			Venus passes mer. 22h. 5m.
	—		Mars passes mer. 14h. 53m.
	—		Jupiter passes mer. 19h. 47m.
	—		Saturn passes mer. 8h. 38m.
	—		Georg. passes mer. 9h. 55m.
	16	10	♃'s second sat. will im.
14			Ecliptic conj. or ● new moon
15			Clock after the ☉ 15m. 11s.
	—		☽ rises 7h. 29m. M.
	—		☽ passes mer. 0h. 18m. A.
	—		☽ sets 5h. 1m. A.
17	19	21	♃'s first sat. will im.
18	9	0	☽ in Apogee
19	13	49	♃'s first sat. will im.
20			Clock after the ☉ 14m. 8s.
	—		☽ rises 11h. 45m. M.
	—		☽ passes mer. 4h. 15m. A.
	—		☽ sets 8h. 49m. A.
	18	44	♃'s second sat. will im.
21	14	44	♃'s third sat. will em.
23	2	24	☽ in □ or first quarter
24	23	43	♄ in conj. with the ☽ diff. of dec. 0. 15. N.
25			Vesta stationary, 12m. 44s.
	—		Clock after the ☉
	—		☽ rises 2h. 7m. A.
	—		☽ passes mer. 8h. 8m. A.
	—		☽ sets 1h. 8m. M.
26	11	33	♅ in conj. with the ☽ diff. of dec. 3. 43. N.
	15	43	♃'s first sat. will im.
28	14	24	♃'s fourth sat will em.
	15	19	♃'s third sat. will im.
	18	41	♃'s third sat. will em.
29			Occul. 48 Tauri, im. 6h. 2m. em. 6h. 57m.
	—		Occul. γ Tauri, im. 7h. 43m. em. 8h. 46m
	—		Occul. 75 Tauri, im. 12h. 12m. em. 13h. 12m.
	—		Occul. θ^1 Tauri, im. 12h. 18m. em. 12h. 52m.
	—		Occul. B.A.C., 1391, im. 13h. 8m. em. 14h. 11m.
	—		Occul. α Tauri, im. 15h. 43m. em. 16h. 42m.
30			Occul. 115 Tauri, im. 9h. 35m. em. 10h. 41m.
	—		Clock after the ☉ 11m. 3s.
	—		☽ rises 4h. 51m. A.
	—		☽ passes mer. Morn.
	—		☽ sets 7h. 30m. M.
	8	25	Ecliptic oppo. or ○ full moon
	16	0	☽ in Perigee

J. LEWTHWAITE, Rotherhithe.

THE
LONDON JOURNAL,
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No. CCXVI.

RECENT PATENTS.

To Fennell Allman, *of Charles-street, St. James's-square, in the county of Middlesex, consulting engineer, for certain improvements in apparatus for the production of light from electricity.*—[Sealed 28th September, 1848.]

This invention of improvements in apparatus for the production of light from electricity relates to the arrangements in connection with the electrodes, poles, or luminous terminals, for the purpose of regulating and maintaining them in a position suitable for the production and maintenance of the electric light; and also to the battery or source of electricity.

In describing that part of his invention which relates to the arrangements in connection with the electrodes, or that part of the voltaic circuit at or in which the phenomenon of light is produced, the patentee remarks, that there are certain well known conditions which are most advantageous for the production of light from electricity; but that, in their attainment, many difficulties of a practical nature occur. The light is best developed by breaking the circuit or conductor, and placing a piece of carbon at the end of the wire or conductor on either side of such break in the circuit; or one piece of carbon on the positive pole, and platinum, iridium, or any comparatively infusible metal or conductor on the negative pole. These pieces of carbon, platinum, or other substances, are commonly called electrodes, poles, or terminals. One great difficulty in attaining a steady and permanent light results from the necessity of a compliance with the following conditions:—First, the electrodes, between which the circuit is broken, should be in contact, so as to complete the circuit, previously to the circuit being broken; secondly, the electrodes should be separated, one from the other, to a certain limited distance, depending on the quantity and intensity of the current employed, and the resistance to its passage, and other circumstances; and, thirdly, the maintenance of the electrodes, or of their terminal surfaces, at such certain limited distances apart, under the variations to which the current is subject, and the destruction and alteration of the electrodes from consumption, dissipation, or other cause. Various means have been resorted to, and arrangements proposed, for effecting this object. Thus it has been proposed to employ continuous conductors of platinum, iridium, carbon, &c., in a state of division; also dust of carbon; also to regulate the distance between the electrodes by a train of wheel-work, resembling clock-work, lifting one of the electrodes,—the rate at which the clock-work is to move being adjusted according to the power of the battery employed for the production of the light. It has also been proposed to employ flat discs of carbon,—the light being developed between their edges; also sticks of carbon, resting on non-conductors. It has also been proposed to make the current of electricity traverse a coil of wire or conductor, and cause an iron cylinder within the coil to rise and fall, according to the quantity of electricity passing, and, in so doing, to govern the mechanism employed to regulate the distance between the electrodes; but these, and other modes of attaining the same ends, are subject to various defects, which interfere with their practical efficiency; and the object of this part of the invention is to attain those ends with greater simplicity, certainty, and economy, than heretofore.

In the arrangements hereinafter described, in reference to the first part of this invention, the same electric current that produces the light separates the electrodes, and, at the same time, keeps them separate, and maintains them at the requisite distance. One of the arrangements employed for this purpose consists of a permanent magnet and conductor, and is shewn in Plate XIII., at figs. 1, and 2. *a, a,* is a permanent magnet, constructed of a number of plates of steel, combined together,—each plate having been rendered permanently magnetic in the usual way:—the thickness of each plate is given in the section fig. 2. This compound magnet is capable of turning on the centres *b, b,* in the spindle *c, c,* fixed in the frame *d,* which binds the plates of the magnet together. Immediately above the magnet, and parallel therewith, is placed a horizontal coil of copper wire or ribbon a^1, a^1, prepared or insulated in the manner usually adopted in electro-magnetic apparatus. This coil consists of about 24 convolutions of copper ribbon, covered with some non-conducting material. When the poles of the battery are connected with this arrangement, and the current of electricity is caused to pass through the apparatus, it enters at *e*, and circulates through the coil round the magnet *a*; from thence it passes to the brass clamp *f*, and through a slip of thin silver foil *g*, into the electrode-holder *h*, to the upper electrode h^1; from the lower extremity of which it passes to the lower electrode *i*, and its holder *j*, and thence through the conductors *k*, and *l*, back to the battery. The wheels *x*, *x*, *x*, are not essentially necessary, being merely friction-wheels, adapted to the upper holder *h*, to guide the same, and facilitate the upward and downward action of the holder and working of the apparatus, in case of rust or other impediments. The electric current, in thus traversing the apparatus, produces the following results:—First, the well-known deflection of the magnet *a*, which is deflected so as to separate the electrodes, by lifting the holder *h*, of the upper electrode by the connecting-link *m*; and, secondly, the production of light at the extremities of the carbon terminals, poles, or electrodes h^1, and *i*. Now the electrodes, by the action of the weight *n*, fixed on the spindle of the magnet *a*, are kept in contact before the current is turned on, or when it is broken; but, when the current is turned on, the deflection or motion of the magnet or needle *a*, separates the upper electrode h^1, as before described, from the lower electrode *i*. Thus the two first necessary conditions are obtained, viz., the primary contact of the electrodes or terminals, and their subsequent separation. The other, or third condition, viz., that the electrodes should separate to only the proper distance, is a necessary consequence of the conditions produced by the above arrangements,—for, as the separation of the electrodes is caused by the action of the electric or voltaic current on the magnet, and as too great a separation after contact would destroy the current, and as the electrodes are always kept in contact by the weight *n*, or when the current is destroyed,—it results that the current, under these conditions, will not destroy itself by too great a separation of the electrodes, but a small separation will be produced and maintained. The cause and effect mutually govern each other, thereby producing a self-acting apparatus, depending only on the supply of a sufficient electric current, and being entirely independent of auxiliary governance or adjustment. The apparatus or lamp, as shewn in the drawing, has the magnet *a*, parallel to the coil a^1; but, when the apparatus is put in action, it is necessary to push the lower electrode *i*, contained in the tube *j*, upwards; lifting, at the same time, the upper electrode h^1, and the holder *h*, and causing the end of the magnet *a*, to deflect in a corresponding direction until it is at an angle of, say, about 30° with the direction of the current in the coil a^1:—a wider coil will give a longer deflection,—that is, it will exhibit the necessary repulsive force at a greater angle. The lower electrode being so pushed up, with the upper one h^1, resting thereon, if the current be made to traverse the copper coil a^1, it will at once separate the electrodes to the required distance, and preserve them so until the magnet, by the destruction of the electrodes, returns to a position parallel to the coil a^1;—the weight *o*, is merely a balance to the weight *n*, of the electrode-holder. The weight *n*, or the force to act against or antagonistic to the dynamic effect of the current, produces steadiness, and prevents flickering or jumping of the electrode; but it must not be so heavy as to prevent a separation of the electrodes. This weight can be adjusted as shewn in the drawing; so that, by means of the screw *p*, it can be brought nearer to, or further from, the vertical position; and it can also be screwed on the spindle nearer the spindle *c*, of the magnet *a*.

In using an antagonistic force, as this weight *n*, it is necessary that, as the deflective force of the magnet diminishes as its angle with the conductor increases, the antagonistic force should also diminish in a like ratio, as the said angle increases. In this apparatus it is accomplished by the weight *n*, being brought more over the centre by the deflection. Its force or weight consequently diminishes as the angle increases. In this apparatus the permanent magnets and conductors are arranged so as to effect the desired purpose by means of repulsion; but it will be obvious that the separation and maintenance of the electrodes at the required distance apart may be effected by attraction as hereinafter more particularly described.

The patentee claims the exclusive use of a conductor or conductors of voltaic or other electricity, in combination with a permanent magnet or permanent magnets, as an improvement in apparatus for the production of light from electricity.

Fig. 3, shews, in side elevation, and fig. 4, in end view, another combination or arrangement of apparatus for the production of light from electricity,—being a combination of permanent and induced or temporary magnets. *a, a,* is a permanent magnet, similar to the magnet shewn at fig. 1. A similar deflection is produced in it, so as to cause the magnet to turn on the centres *b,* by the repulsive effects between the similar poles *c,* and c^1, of the induced magnet *d,* d^1, and the poles of the permanent magnet *a.* The current enters at *x*; and from thence it flows through a coil of copper wire or ribbon (prepared or insulated in the usual manner), around the soft iron *c,* which thus becomes a magnet by induction;—the magnet, with its coil, being contained in the brass tube or case *d.* The electric current passes from the coil through the frame *e,* to the other induced magnet, similar in arrangement to that just described; around which it also circulates; thence through the copper band *f,* into the support *g,* and, by the slip of silver foil *h,* into the upper electrode-holder *i,* to the upper electrode *j*; and from thence to the lower electrode *k,* and through the holder back to the battery. The apparatus is prepared for action in the same manner as that first described, viz., by pushing up the lower electrode *k,* and thereby increasing the distance between the respective poles of the magnets; and then, if the current is turned on, the electrodes (resting one on the other, as in fig. 1,) will be separated to the requisite distance, governed by the weight *l,* which is similar in its office and effects to *n,* fig. 1. The same remarks, as to construction, equally apply to both arrangements;—the balance-weight *m,* is employed as a counterpoise. Fig. 5. represents one of the induced magnets *d,* in section.

The patentee claims the exclusive use of permanent magnets, in combination with induced or temporary magnets, as an improvement in apparatus for the production of light from electricity.

Fig. 6, exhibits, in side elevation (partly in section), an apparatus by which another of the dynamic effects of the voltaic current (namely, the repulsion between similar poles of induced or temporary magnets) may be employed. These induced magnets consist of soft iron, rendered magnetic during the transit of an electric current through a coil of covered copper wire or ribbon, as described in reference to fig. 3. When these magnets are rendered magnetic, under the influence of the voltaic current, the approximate poles *d,* and *e,* and d^1, and e^1, of the magnets, are similar. This is caused by making the current to circulate in the proper direction around the soft iron, as is well known; but the magnets *a,* and a^1, are fixed on either end of the balance-rod *c, c*;

to which is connected, by the arm *f*, and connecting link *g*; the upper electrode-holder *h*; so that any motion caused by the movement of the rod *c*, on its centre c^1, is thus communicated to the electrode *i*. The action of this apparatus is as follows:—The electric current enters the apparatus at *k*, and circulates round the magnet *b*, into its brass case, which covers the conductor; then through a slip of silver *l*, (sufficiently flexible to admit of the magnets *a*, and *b*, separating) around the other magnet *a*, through the rod *c*, into and round the magnet a^1, at the opposite end; from which it circulates round b^1, and through the slip of silver *m*, to the upper electrode-holder *h*, into the upper electrode *i*, to the lower electrode *j*, through the lower holder *n*, rod *o*, and conductor *p*, back to the battery. On examining the drawing, it will be seen that at many parts of the apparatus a non-conducting substance is placed, to prevent the current from diverging from the proper circuit. Now, the effect of sending a current of electricity through the apparatus is, first, to render magnetic the several soft iron pieces under its influence simultaneously. The immediate consequence is, that the said electro-magnets *a*, and a^1, repel *b*, and b^1; but, as *b*, and b^1, are fixtures, *a*, and a^1, move away from them,—being permitted to do so by the movement of the bar or lever *c*, on a centre c^1, and the flexibility of the conductors of silver between these magnets; but this separation of the magnets separates also the electrodes, as the bar or lever *c*, lifts the holder *h*, as before explained. The dynamic effect, therefore, exhibited by the repulsion between the magnets, tends to separate the electrodes *i*, and *j*; but, as it is the current that thus produces this separation, and as too great a separation would destroy the said current, it will only separate the electrodes to a certain distance (the cause and effect being in equilibrium);—this distance being that which is necessary for the production of the light between the electrodes *i*, and *j*. By pushing the bottom electrode *j*, up, it will move the magnets *a*, and a^1, from the magnets b^1, and *b*, which will again approach each other as the electrodes are diminished from any of the causes incidental to the operation of the apparatus. The result obtained in this self-acting apparatus is similar to that of the before-described arrangements; but the mode of employing the electric current is different. In this combination, in which induced magnets only are employed, if the soft iron were removed from the centre of the conducting coil, the same effects would be produced, but in a minor degree. The arrangement would then consist of the repulsion between similar poles of conductors only; and such an arrangement may also be employed for the production of light from electricity.

The patentee claims the use of conductors, arranged so as to produce a mutual repulsion, as an improvement in apparatus for the production of light from electricity. He remarks, that the arrangements of apparatus, at figs. 3, and 6, are described as actuated by the repulsive effects between similar poles of magnets; but, if opposite poles were placed in proximity to each other, attraction would ensue between the opposite poles. If the apparatus were thus changed, by reversing the poles and position of the induced magnets or conductors, it will be evident that the motion in the parts, caused by this said attraction, could be used to separate the electrodes and maintain them separate, and produce the same results as the repulsive effects hereinbefore explained. He therefore claims the use of induced magnets and conductors, or conductors only, in combination, and acting by attraction or repulsion, as an improvement in apparatus for the production of light from electricity.

Fig. 7, represents a side view of another arrangement of apparatus for the production of light from electricity. *a, a,* is a lever, having one end turning freely on the fixed centre *b,* and the other end attached to the upper electrode-holder *c, c,* by a piece of wire-rope or cord *d.* This cord is soldered both to the lever *a,* and electrode-holder *c,* to ensure a good connection. Any upward movement therefore of the lever *a,* on its pivot or centre *b,* would lift the electrode *e,* from the lower electrode *f;* but the spring *g,* constantly presses the lever *a,* in this direction, and would, consequently, if not controlled, separate the electrodes. This, however, is prevented by the compound bar or rod *h, i,* which is fixed to the plate *l.* The upper end of this rod is threaded, and receives a milled nut *m,* which is screwed down on to the spring *k,* until it so acts against the spring *g,* as to keep the electrodes *e,* and *f,* together. The lower end of the piece *i,* is formed into a socket, which receives a cock *n;* and into the socket the piece *h,* is fitted by a non-conducting bush. The current of electricity, upon entering by the copper ribbon *o,* passes up the bar *h,* through the plug *n,* of the cock, through *i,* and the spring *k,* to the lever *a, a;* then along the cord *d,* and the holder *c,* to the electrode *e,* and thence to the lower electrode *f,* the holder *p,* and conductor *q,* back to the battery. The plug of the cock *n,* (which is, on one part, filed flat) being in the position shewn in the drawing,—that is, so placed that the flat part is, in some measure, presented to the conductor *h,*—it does not afford a sufficient conducting surface of contact between the plug and bar *h*. The result is, that, as this surface contact is diminished by turning the cock, the cock and bars *h*, and *i*, become heated by the passage of the current; and this heating effect can, by setting the plug *n*, of the cock, be made to suit the quantity or nature of the current employed; so that a given current shall always produce a given heating effect, or heat the rod *h*, *i*, as much as is necessary. But the same current passes also from one electrode to the other, as before described; and, when the rod *h*, *i*, becomes heated, it expands, and, by its elongation, allows the spring *g*, to separate the electrodes *e*, and *f*, by lifting the lever *a*, as described. When the current is cut off, the bar *h*, *i*, cools, and, by its contraction, the electrodes return into contact. Fig. 8, is a detached view of the fork of the bracket *r*, and lever *a*,—the latter being shewn in section.

At fig. 9, another arrangement, by which the heating effects of the current may be made to govern the position of the electrodes *e*, and *f*, is shewn. This is effected with the assistance of a compound bar *s*, *t*,—the electric current being sent through the bracket *u*, into the bar *s*, *t*, across the link *v*, which couples it to the lever *a*, and thence, as before, through the electrodes to the battery;—the bar *s*, *t*, being made of such a size that the current will, by passing through it, heat it sufficiently to cause it to curve or bend upwards (*t*, being the convex and *s*, the concave side of the curve), owing to the unequal expansion, under a similar temperature, of the brass bar *t*, and steel *s*, which are attached together by the rivets *x*, *x*, *x*. This curving of the bar, it is evident, will, by lifting the lever *a*, by means of the link *v*, separate the electrodes. As, in either of these arrangements, the current, by thus separating the electrodes, tends to destroy itself, it will be evident that, by turning the cock *n*, or proportioning the size of the bar *s*, *t*, the cause and effect, as to heating and separation, will mutually govern each other.

The patentee remarks that, by various other analogous arrangements, the calorific effect of a current of electricity may be rendered available for separating the electrodes and maintaining them at a proper distance from each other.

He claims the use of apparatus whereby the heating effects of electricity may be employed and rendered available for the production of light from electricity.

Fig. 10, represents, in elevation, an apparatus, by which the decomposing effects of the voltaic current may be employed to regulate the electrodes, poles, or luminous terminals of the voltaic circuit. The same apparatus may also be employed to indicate the intensity effects (commonly so called) of the voltaic circuit. *a, a, a,* is a brass frame, in which a brass tube b^1, slides vertically. The open or lower end of this tube is fitted into the cover or air-tight lid *c*, of the glass cylinder *d, d.* This cylinder *d,* contains two platinum plates *e*, e^1, about 2½ inches wide, and placed about ¼ inch apart: these plates act as a common volta-meter. An exterior concentric glass vessel *f*, surrounds the cylinder *d,* and contains the liquid for decomposition. The action of the apparatus will be as follows:—When the circuit is made, the current enters at *g*, through the spring-conductor *h,* into the arm *i*, to the plate *e*, across to the plate e^1, (as the arrows indicate) to the other arm i^1, and through the other elastic conductor h^1, to the lower electrode-holder *j*, and electrode *k*, and thence to the electrode *l*, and conductor *m*, back to the battery. The effect of the current of electricity, so traversing the apparatus, is, first, that the liquid (sulphuric acid and water) is decomposed, and the gases, given off, in rising, enter the sliding tube *b*; but, as they accumulate, the cylinder *d,* (with the contained plates *e*, and e^1,) is lifted, and slides upwards, with the guide-tube *b*, against the pressure of the conductor-springs *h,* and h^1. The gases will now have no aperture through which to escape; the screw *n*, therefore (the conical end of which enters the tube at *o*,) is turned, and the hole *o*, of the tube is thereby opened, which will allow the gases to escape; but, if this egress for the gases be insufficient, they will accumulate and lift the cylinder *d,* until the condensation produced by the re-action of the spring-conductors *h,* and h^1, forces the gases out at the said hole *o.* If the decomposition be at the rate of twenty cubic inches a minute, as a constant quantity, and supposing the hole *o*, be opened a little, and the cylinder *d,* to rise half an inch, it will be evident that, if the quantity of gases increase, say to thirty inches per minute, they cannot escape through the same sized aperture, at the same pressure or condensation. They will, consequently, lift the cylinder *d,* and thus obtain a greater pressure from the springs *h,* h^1, when the thirty inches per minute will be enabled to escape through the same aperture *o.* Now, on the tube *b*, is a button *q*, which holds down the ends of the levers *r*, r^1, which turn on the centres *s*, and s^1; but the end of the lever r^1, is, as shewn in the drawing, connected to the lower electrode slide-holder *j*, which is capable of sliding up and down. The current, therefore, when turned on, first decomposes the fluid, and, by thus lifting the cylinder *d*, the tube *b*, and button *q*, lowers the outer end of the lever r^1; but this would separate the electrodes, and, consequently, produce the second proper condition for the production of light; as too great a separation would destroy the current, and, consequently, destroy the decomposing effects, or the cause of the separation. The electrodes will, therefore, remain apart the proper distance for the production of light. The other lever *r*, is used as an indicator: the rise and fall or fluctuations of which will denote the variation, in intensity, in the current of electricity passing through the apparatus. The electrodes are shewn enclosed in a glass vessel, made as air-tight as possible.

The patentee claims the apparatus so arranged as to render available the decomposing effects of the voltaic current, or a current of electricity, for regulating the electrodes, as an improvement in apparatus for the production of light from electricity; and also the use of the volta-meter, above described, as an improvement in apparatus for the production of light from electricity.

The second part of this invention, which relates to apparatus employed in obtaining electricity, consists in certain arrangements of apparatus for regulating the emission of the fluids of the battery and the ingress also of the fluids.

In fig. 11, which is an elevation, partly in section, of one arrangement, *a*, *a*, is a syphon;—its broken end is to be connected with that part of the battery from which the liquid is drawn; the other end is shewn immersed in a glass vessel *b*, into which it discharges; but this glass vessel is kept constantly full, and is suspended by an arm to the pin *c*, of the lever *d*, which turns on the fixed centre *g*. The glass vessel *b*, is balanced by the weight *e*. The top of the vessel must be a little below the level of the liquid in the battery, so that the discharging leg of the syphon, immersed therein, may be made a little longer or deeper. Now, if the syphon should draw off a very heavily saturated solution, such, for example, as sulphate of zinc, the vessel (being always full) will, by its increased weight, fall lower; and, by its thus lengthening the discharging leg of the syphon *a*, will increase the discharge until it begins to draw off liquid not so heavily saturated, when it will lessen the discharge by rising again. The same object is accomplished by the ball *a*, fig. 12, rising, when the liquid, whose level remaining at *g*, becomes more heavily saturated. By thus rising, it opens the discharge-pipe *b*, by the throat-valve *c*; which valve it again shuts when the ball sinks to the standard level due to the proper saturation of the liquids drawn off.

The patentee claims the use of apparatus so constructed and arranged that the variation in the specific gravity or degree of saturation or exhaustion should be made to regulate the discharge of the liquids from the battery.

In some cases the patentee employs pumps, or other hydraulic apparatus, to force or draw the liquids used in the battery. The apparatus, so employed, should be made of glass, porcelain, platinum, or some material not ordinarily acted on by the liquids employed. The circumstances under which this hydraulic apparatus is employed are, when the battery is at a great distance from the acid or supply reservoir; or where there is a great difference in the level of acid or liquid cistern and the battery; or in cases in which a syphon, as already described, is inapplicable, and cannot be employed with advantage.

He claims, lastly, the use of hydraulic apparatus, which requires to be worked by power or force, adapted to, and in combination with, the voltaic battery, as an improvement in apparatus for the production of light from electricity.—[*Inrolled March,* 1849.]

To William Henry Green, *of Basinghall-street, in the City of London, Gent., for an invention of improvements in the preparation of fuel,—being a communication.*—[Sealed 5th March, 1849.]

This invention of improvements in the preparation of fuel refers, firstly, to a mode of drying peat, to be used as fuel; and, secondly, to the charring of peat, in a manner that will admit of the volatile oils, and other volatilizable substances which it contains, being driven off, without the great waste of carbon being experienced that follows from the present mode of charring.

In Plate XIV., fig. 1, represents, in vertical section, and fig. 2, in sectional plan, an improved construction of kiln or drying shed for the peat. It consists of a rectangular brick building, with an ordinary kind of ventilating roof. The floor of the shed is formed of iron plates, pierced with holes at certain parts, to allow of heated air from below passing through them. Beneath this flooring are a series of serpentine or winding flues or hot-air passages *a, a,* built of bricks, and covered in with tiles. In connection with these flues are (by preference) two fire-places *b, b,* and a common chimney *c.* Beneath these flues of the kiln or drying shed, free access of air, at the ordinary temperature, is allowed; and set in the tiles, which form the covering of the flues, are a number of small wrought-iron vertical pipes, which form channels for conducting the air upwards into the mass of peat which is piled upon the floor. When the flues are arranged as shewn at fig. 2, the peat (which is cut from the bog in rectangular blocks of uniform size, and has been partially dried in the open air) is piled up over the flues with regularity; passages being left between each pile for the circulation of air and the escape of the moisture from the peat; but, when they cover the whole surface of the floor, the blocks of peat may be thrown in through a trap door in the roof, until the building is nearly full. In this latter case, however, it will be necessary to apply an exhausting apparatus at the top of the building (as shewn at fig. 1,), in order to cause the air to flow up through the air-pipes and distribute itself through the mass of peat, that it may carry off the moisture therefrom. The drying is effected in the following manner:—The fire-places *b*, *b*, are charged with peat fuel, and the heated air and gases, arising from the combustion of the peat, traverse the flues *a*, *a*, heating all the vertical air-pipes which they encounter on their passage to the chimney *c*. These pipes, which (as before stated) are the channels for conveying air to the piles of peat, will impart heat to the air as it passes through them, sufficient to act upon the peat and drive the moisture therefrom. The temperature, to which the air that is to act upon the peat is raised, should not exceed 130° Fahr. If an exhausting apparatus is applied to the kiln or drying shed, it is now set in motion by any first mover, and, as quickly as the evaporation takes place, the moisture is expelled from the kiln. When the exhaust apparatus is not employed, the vapour rises and passes off through the openings in the roof. The drying operation will require to be kept up to from two to five days, according to the state of the peat when placed in the kiln. In fine weather, when the peat can have a previous drying in the open air, the kiln drying may be effected in about two days; but it is not desirable to drive out the moisture very quickly, as the peat is liable to crack and fall to pieces;—if, however, the operation is conducted slowly, the peat will consolidate, and be better suited for the ordinary purposes of fuel, as well as for conversion into charcoal.

The second part of the invention consists in an improved arrangement and construction of apparatus for charring peat in an economical and efficient manner. Fig. 3, shews the apparatus in front elevation, partly in section; fig. 4, shews it in transverse section; and fig. 5, is a plan or top view of the same. This apparatus consists of a series of retorts A, set in pairs in suitable brickwork, and surrounded by flues B, B; into which the heated gases from the several furnaces C, are conducted by the branch flues *c*, *c**, leading from the furnaces; and by these flues B, the heat is deflected upon the retorts which they respectively surround. At the upper end of the flues *c**, sliding damper-plates *d*, *d*, are placed, to allow of the attendant checking the passage of the heated gases up these flues, and turning them into the flues *c*, *c*. The retorts are tubes, composed, by preference, of sheet-iron, from one-eighth to three-sixteenths of an inch thick, and having a D-shaped section: they are set horizontally and parallel to each other in the brickwork, and both their ends extend through the same, as shewn at fig. 4. The ends of the retorts are closed by outer doors *a*, *a*, of iron. These doors are each held in their places by means of a bar,—the ends of which are inserted into lugs or ears on the ends of the retorts: a screw, passing through the middle of this bar, is turned, until it abuts against the door, and binds it tight against the end of the retort. *b*, *b*, are inner doors, composed of fire-clay, and forming, with the outer doors *a*, an air packing, whereby the heat is confined within the brickwork of the furnace, and is more uniformly distributed through the retort. The inner doors *b*, fit against a lip or rib in the retorts; and they are kept in their vertical position by a strut or bracket, attached to them, and resting on the bottom of the retort. For every two retorts a furnace C, is provided; and from the sides and crown of the furnace a series of flues *c*, *c**, lead off to the flues B, B, which surround their respective retorts. The gases, after heating the retorts, pass off by the flues B*, B*, into a general flue D, which conducts them off to the chimney C. These flues B*, B*, are each provided with a damper for regulating the escape of the heated gases from the flues B, and thereby giving the attendant a command over the charring operation. In connection with each retort are two vertical pipes E, E, which rise through the brickwork, and are bent over at their upper end for the purpose of being connected to one of a series of pipes F; which pipes are intended to carry off from the retorts the volatile substances evolved from the peat, and convey them through a common pipe G, to a condenser H. Each of these pipes F, is provided with a stop-cock *e*, for cutting off the connection with the pipe G; and above the stop-cock is a jet, for ascertaining the amount of gas being given off by the peat. In the condenser H, the tar and ammoniacal liquor, resulting from the process of distillation, is deposited; but the gases are conducted by an inclined pipe to a gasometer. This pipe is placed in a gutter, down which a stream of water runs in an opposite direction to the passage of the gas, for the purpose of cooling the same and condensing the aqeuous particles escaping with the gases: the pipe being on an incline, will allow of this liquor flowing back into the condenser H. The gases, thus distilled, being very inflammable, are conveyed from the gasometer to the several furnaces, and are employed therein as fuel, in combination with dried peat, which is used to commence and keep up the distilling operation. There are four pairs of retorts shewn in the drawings; but it is obvious that a greater or lesser number may be employed, according to the extent of the operations desired to be carried on.

The following are the details of the mode of operating with this improved apparatus:—The furnaces being charged with peat fuel (which, when burning, will have no injurious effect upon the thin sheet-iron retorts), the fires are lighted; and after about twelve hours (the retorts being by that time brought to the proper degree of temperature), they are filled with a quantity of peat, packed regularly in baskets, made of hoop-iron, and of such a shape that they will fit the retorts,—their length being such that, say three baskets will fill a retort. The top of the baskets ought not to exceed the sides of the retort in height. There should be a double set of these baskets, so that, when the retorts are discharged at one end, there may be other baskets in readiness to charge them with at the other end. When the baskets of peat are placed in the retorts, the doors of the retorts are hermetically closed, and the temperature is raised, until a cherry-red heat is obtained. This temperature is kept up until the gases cease to be given off by the peat, or, at least, are very slowly evolved. To ascertain this, the attendant turns off the cock *e*, in the pipe F, which is in connection with the retort first filled, and turns on the gas jet. To this he applies a light, and if the gas burns very feebly, he knows that the charring is completed. He then opens that retort and draws out the charcoal, and places it, in an incandescent state, in air-tight cases, wherein it is allowed to cool. These cases must be provided with a two-way valve, to allow of the escape of heated air therefrom, and, as the peat cools, to allow air to flow in, to fill up the vacuum; and they may be mounted on wheels, and made to run on railways, for the greater convenience of moving them.

If the charcoal be required to burn without flame, then the process will have to be continued until the inflammable gas almost entirely ceases to come over; but, if the charcoal is wanted to burn with a flame, the process will be completed when the gas comes over in a moderate volume. It is important that the attendant should give particular attention to this test of the progress of the operation; for, after the inflammable gases are evolved, the waste of the charcoal quickly takes place, from great quantities of the carbon being carried off with the evolved gases. The several retorts are opened and discharged at one end in succession; while the workman on the other side of the apparatus removes the doors at his end of the retorts, and re-charges the retorts in regular succession with baskets of dried peat. When he has filled a retort, he pushes the fire-clay door up to its place, and applies the outside iron door, luting it round with clay, as is well understood. The workman at the other end does the same, when he has withdrawn the charged peat; and thus the operation is made continuous. To effect a saving in the time of re-charging the retorts, it has been found advisable to have a duplicate set of outer doors, which will allow of the workmen applying cool doors, and luting them up, instead of waiting until the doors just removed have had time to cool.

The patentee claims, First,—the mode of supplying heated air to the drying house or kiln, for drying the peat and preparing it for fuel, as described, with reference to figs. 1, and 2. Secondly,—the arrangement of apparatus for charring peat, as described with reference to figs. 3, 4, and 5, whereby the operator is enabled to ascertain the progress of the operation, to stop it at any required stage of the charring process, and thus to effect a great economy in the production of peat charcoal, as above mentioned.—[*Inrolled September,* 1849.]

To WILLIAM KILNER, *of Sheffield, in the county of York, engraver, for improvements in manufacturing railway and other axles and wheels, and in machinery to be employed in such manufacture.*—[Sealed 24th April, 1849.]

THE first part of this invention consists in the use of an improved construction of smith's hearth, for the purpose of welding the spokes of railway wheels on to the tyre or inner rim thereof.

In Plate XV., figs. 1, and 2, represent the improved hearth in front view and cross section. The manner of using the hearth is as follows:—The tyre or inner hoop is bent in the usual way, and being placed on the hearth, as shewn in the figures, the inner surface of such tyre or hoop is brought to a welding heat;—the end of the spoke to be welded inside the same being also heated to a welding heat, in a common smith's fire. When both are at a suitable temperature, the rim is brought out and turned over on a block, as shewn at fig. 3, when the arm is placed upon it and welded and swaged into the desired form. *a*, and *b*, represent the end of the spoke, and that part of the inner tyre or hoop which has been heated in the projecting hearth. The same method is also adopted when it is desired to weld the arms to the outer tyre of the wheel, so as to dispense with the inner ring or hoop. When the arms are all welded to the tyre, the patentee proceeds to make the wrought-iron nave, which he welds on at both sides of the spokes at one operation. In order to accomplish this, he first prepares the nave in two rings, a section of one of which is shewn at fig. 4,—the said ring being composed of a coil of bar-iron, bent either flat or edgeways, as shewn at fig. 9; and which, being heated to a welding heat, in a suitable fire or furnace, is formed in tools or dies, under a vertical or other hammer. Having roughly prepared the end of the bar, forming the spoke, in the manner shewn at figs. 5, and 6, so as to avoid the labor hitherto found necessary in forming the same, he arranges them together as there shewn; the latter figure representing a plan of the spokes and the bottom ring, with the upper ring removed. The parts of the nave are then connected together by two wrought-iron rivets, as shewn at fig. 5, and the whole is put into a furnace; unless it is preferred to heat the ends of the spokes separately from the naves; in that case, the rings or half naves and ends of the arms are heated in separate furnaces, or on smiths' hearths; but, for heating the ends of the spokes, or naves and spokes combined, a hollow fire or furnace is preferred,—it being necessary to have an uniform heat, or nearly so, on all parts. The kind of furnace which the patentee employs for this purpose is shewn, in vertical section, at fig. 7. The wheel, being heated to the temperature required, is brought out and placed between tools or swages, of such form as to close the two rings uniformly upon and between the ends of the spokes;—such space having been left between, as shewn at figs. 5, and 6, and holes having been punched, or other pieces cut out of the spokes, to allow the metal, as soon as brought under the hammer, to close up and weld through, as well as with and between, the ends of the said spokes, and thereby cause the union of the two rings or half naves. The small projecting pieces *a*, *a*, fig. 4, in the centre of the said rings, are for the purpose of closing up and over the ends of the spokes, and for giving a regular and sound hole, when bored, for the axle: this is accomplished by driving a taper drift or steel pin partly through the boss or nave, on each side, whilst still at a welding heat. The tools or swages should be of such form as to give the boss the shape shewn at fig. 8, between the spokes; as, by such means, the more perfect union of the upper and lower rings will be secured. It will be evident that the same manner of making and preparing the arms and tyres will be applicable to wheels intended to be made with cast-iron naves. The patentee further proposes to form the overhanging hearth, before described, so as to produce what is termed—"a hollow fire," to be used in welding the tyres of railway wheels by pressure. Figs. 10, and 10*, represent, in front elevation and vertical section, an overhanging closed hearth,—the upper part being loose, and capable of being raised by means of a lever, to admit of the tyre being put into and taken out of the furnace. The tyre is placed in the hollow fire or furnace, and brought to a welding heat, and the screws of a chain, which embrace the hoop or tyre, are gradually tightened until a weld, by this means, is effected. The hoop, at this time, is clear from all contact with the fuel, and thereby ensures a perfectly clear and sound weld. When the weld is effected, the hoop is taken out of the furnace, and the thickened part is swaged down: the furnace is fed at the hole *a*,—the same being stopped with a fire-clay plug, as soon as the fuel is put in. The flues are two small holes in the cover, as shewn by the dotted lines *b*, *b*.

Under this part of his invention, the patentee claims, First,—the use of a hollow fire or enclosed hearth, for heating tyres to a suitable heat for the purpose of welding;—such means being much more economical and convenient than those now employed. Secondly,—the projecting hearth, for heating the inner surface of a tyre or felloe of railway wheels; but, as it is obvious that the form and arrangement of the hearth may be changed, he claims, in the process of welding the spokes on to the tyre or felloe of railway wheels, the causing of heated air or gases to impinge upon the inner surface of the tyre or felloe, in contradistinction to the present mode of heating the same by radiation, as in a smith's hearth. Thirdly,—the forming of the rings or half naves of bars of iron coiled into the form shewn at figs. 9; and the method of heating the spokes and half naves, either together or separately, so as to complete the formation of the nave at one heat,—with the particular mode of arranging the spokes and rings forming the naves; by which means sufficient spaces are left between the spokes, and through the spokes themselves, by either punching holes or cutting out pieces, so as to allow a union between the rings forming the upper and lower side of the nave;—and also for completing the solidity of the nave by welding down over the ends of the spokes the projecting pieces *a*, *a*, fig. 4, by means of the taper drifts before described. Fourthly,—the use of a hollow furnace for heating the tyre to a suitable heat for welding, although the form of such furnace may be altered from that above described.

The second part of the invention consists in forming the arms of wrought-iron wheels direct from the puddled or scrap bloom. This operation is accomplished by means of dies or swages, worked under a hammer, by taking a bloom of sufficient weight for working two or more arms at a time, as shewn at figs. 11, and 12. The arms, being so prepared, are broken through the middle at the part *a*, or *b*, and are welded separately to the inside of a hoop, or part of a hoop, as before described;—the ends of the bars coming together in the centre, as shewn at fig. 13. On each side of the nave, which is thus formed by the inner ends of the spokes, a cap for forming the swell of the nave is placed; and these several parts are heated to a welding heat, and welded together. Or, instead of welding the arms to a bent or circular bar, the patentee takes a straight bar of iron, of sufficient substance and length for making the inner tyre, and welds the arms at suitable distances along such bar, as shewn at fig. 14; and, having a circular block, as shewn at fig. 15, (the pieces *a*, being loose, and each one of such pieces having a small recess *b*, cut in the plate to receive it) he heats the bar with the arms upon it, in a suitable furnace, and (as shewn at fig. 15,) bends it round the block, attaching the piece *a*, thereto before the arm *c*, is bent up to it, and also the next piece *d*, before the arm *e*, is brought round,—and so on until the circle is complete, as at fig. 13. This or any other description of wheel having been so prepared, the patentee proceeds at once to bend and shrink the tyre on the wheel,—the wheel itself being made use of instead of the bending block; and the tyre being bent round by any of the modes well known and practised by railway wheel makers. The wheel itself is secured on the moveable plate by means of sliding blocks of iron, forced by wedges against the inside of the inner tyre;—the wheel having been previously bored and dropped on to a pin in the centre. By these means the expense of heating the tyre for blocking, and afterwards of re-heating for the purpose of shrinking on is avoided; and, although the tyre is not at first shrunk on the body of the wheel so tightly as in the ordinary manner, still the welding up of the tyre, and the further contraction occasioned by the mode of rolling, hereinafter described, renders the tyre, when finished, equally tight upon the wheel; and, in the process of welding up, part of the outer tyre will become welded to the inner wheel, which will tend to prevent accidents, in case the tyre should, from any cause, become loose on the wheel. When a renewal of the tyre is necessary, the piece must be cut out, and the inner rim or tyre may be repaired, at a very trifling cost. In order to render the contact between the inner and outer tyre still more solid and complete, the inner tyre is formed with a dovetailed section, and fits into a recess in the outer tyre, prepared to receive it, as shewn at figs. 16; but it is the manner of effecting this economically and effectually, by means of machinery, which forms an important feature of this part of the invention.

This improved arrangement of machinery is shewn in plan, sectional elevation, and end view, at figs. 18, 19, and 19*; the section, fig. 19, being taken through the line *j*, *k*, *l*, *m*, of fig. 18. *a*, *a*, is the foundation plate of the machine, having projections cast upon its upper and lower surfaces for facing, at such points where any part of the machinery may be in contact with the same; *b*, fig. 19, represents a sectional elevation of the upright spindle and block or table upon which the wheel to be acted upon is fixed; and *d*, is the wheel, which is to be held firmly in its place by the pin *c*,—the hole in the nave of the wheel having been previously bored to receive it. The lower part of the upright shaft *b*, works in a plummer-block, of any suitable form, and is either attached to the side of the foundations, or is worked on its point resting in a block, as may be desired: the drawing shews the plummer-block *e*, attached to the side of the foundation. On this shaft revolves a spur-wheel *f*, to which motion is given by a driving-wheel, the position of which is shewn at *g*, fig. 18. The wheel *f*, is loose on its shaft, for the purpose of conveying the motion from the driving-wheel *g*, to a wheel *g**, of equal size, on the opposite side of the table, and which communicates the motive power to the two rollers *n**, *n**. This driving-wheel *g*, is fixed upon an upright shaft, to which motion is given by a pair of bevil-wheels, with reversing clutch, in the usual way. *h*, *h*, *h*, are four levers, having rollers *n*, *n*, *n**, *n**, at their ends, and working on four points or pivots *i*, *i*, *i*.

These rollers are made to approach or recede from the wheel by the action of the screws *o, o,*—motion being given to the same by the small handles at *p*, fig. 18: the bevil-wheels and shaft there shewn are for the purpose of preventing one pair of levers from pressing more upon the tyre of the wheel than the other pair. q^1, q^1, are two pinions, driven by the wheel *g*, and revolving loosely on the spindles *i*, of the levers *h*. These pinions gear into similar pinions *q, q*, which are keyed upon the spindles of the rollers *n, n*, causing the same to revolve; and a similar arrangement of gearing is provided for actuating the rollers *n**. *r, r*, are the end frames, with long rollers or pressers fitted into the same; the line of their position on the plan being *j, k*. These rollers are fitted with a collar and recess, as shewn at *s*. The bottom roller rests in its bearings in a lever, as shewn at *r**, and can be lowered when the wheel is first put into its place, and afterwards gently raised, by means of the screw *q**, against the under edge of the tyre of the wheel; the upper one being pressed continually against the top brasses by the spring *t*. Each of the frames *r, r*, is provided with such spring, the force of which is sufficient to raise the collar of the upper roller completely out of the recess in the lower one; when the upper roller can be pushed back into the position shewn by the dotted lines. These rollers have no driving machinery in connection with the machine itself, but are acted upon by, and act upon, the wheel, in the manner to be presently explained. The mode of making the tyre of a wheel, or the wheel itself, in the machine, is as follows:—The hoop or outer tyre, with the dovetail lips, is bent in the usual manner, whereby the lip *a*, fig. 17, is thrown back, as shewn by the dotted lines, and the tyre is welded up in this form. The wheel is now dropped into the tyre, and they are both heated to a suitable heat for being pressed or rolled; and the upper roller in the frames *r, r*, being drawn back into the position shewn by the dotted lines, the wheel is placed in the machine, and secured in its position by the pin *c*. The next thing is to push forward the upper roller in the frames *r, r*, until it hangs over the edge of the tyre of the wheel; and to press it down upon the tyre by the screws *u, u*, which, through the medium of the pinions *u**, *u**, give motion to the upright spindle and screw *q**. This screw, by means of the lever *r**, raises the bottom roller into contact with the under flanch of the tyre, at the same velocity that the upper roller is made to descend; and the rollers *n, n, n**, *n**, are then all pressed forward with uniform force by the screws *o, o*, acted upon by the handle at *p*, which drives the two screws at the same speed, by means of a telescope shaft in connection with the bevil wheels. This telescope shaft is suitably mounted in bearings, and, by its contracting and elongating property, allows of the screws approaching and receding from each other as may be required. The machine is put in motion by the clutch before described, and the driving-wheel *g*, which causes the rollers *n, n*, to revolve, as well as the loose wheel *f*, upon the shaft *b*. This wheel *f*, gives motion to the rollers at the end of the levers on the other side of the table, through the wheel *g**; and the wheel *d*, is made to revolve entirely by the friction of the rollers against its periphery. At the same time the upper roller in the frames *r, r*, is gently forced down by the screws *u, u*, and the lower one raised by the same means; and these rollers are caused to revolve by the friction of the edges of the tyre upon them,—the wheel being kept in motion, and the pressure continued, by the rollers *n, n, n*, n**, as well as the rollers *w, w*, until such time as the wheel or tyre shall have assumed the shape and rotundity required. The patentee remarks that it is not necessary to have flanches or lips rolled upon the inner side of the tyre, as it will be evident that, if the tyre is made rather wider than usual, the pressure of the two rollers in the frames *r, r*, will cause the same to overlap the wheel, and by this means complete the dovetail or overlap required.

This machine, it is stated, may be made to act upon wheels having a tyre of any other section, or upon the inner tyre of any wheel, for the purpose of rounding it, or upon the outer surface of any tyre, for the purpose of blocking it in the usual way;—the surface and edges of such tyres being made true at one and the same time, and with such accuracy as in many cases to render any turning unnecessary, and in all to accomplish the completion of the wheel with great economy in labor and material. In order to effect the rounding of the wheels more perfectly, so as to render turning unnecessary, the patentee fixes a scraper, of the form of the tyre of the wheel, at the point *z*, and forces this forward through two square eyes or guides by means of a screw, so as to remove the scale from the face of the tyre: this scraper, however, should not be used until the wheel is nearly circular; and it is intended, by cleaning the iron, to give a more perfect and uniform surface to the tyre. This machine can also be applied to wheels of different diameters, as the action of the screws *o, o*, will expand or diminish the space, to receive the wheel between the rollers *n, n, n*, n**; and the frames *r, r*, will slide upon the foundation-plate,—the screws *x, x*, fig. 19*, passing through slots for that purpose; or the circle may be still further increased, by having holes to suit the pins *i, i, i,* at the same distance from the centre of the wheel *g,* as shewn by the dotted circles *y, y, y.*

The patentee claims the manner of acting with two or more rollers on the outer surface of a tyre, or wheel, or wheel when tyred; such rollers being caused to advance and press against the surface and edges with accuracy and uniformity, and in conjunction with a scraper. He further claims the rolling of the tyres during the process of shrinking on.

The third part of the invention consists in the application of circular and revolving cutters to the turning of railway wheels when cold. At fig. 20, *a, a,* represent a pair of railway wheels in an ordinary lathe, intended to revolve at a slower speed than usual; *b, b,* are two circular cutters, keyed upon a shaft, to which motion is given by a strap working on a pulley at *c*; and *d,* is a loose pulley on the same shaft, which revolves in bearings at *e, e.* These bearings are capable of sliding to and fro in the dovetailed recesses of the upright standards *f, f,* by means of the screws *g, g,* which are actuated by the handle *h,* and connecting-shaft *i*; and thus the position of the cutters *b,* is regulated. The circular cutter may be also applied to the boring out of the tyre, and to facing the edges. To accomplish this, a slide-rest is arranged at right angles to the wheel and face-plate of the lathe; the cutter is made to advance and recede to and from the face-plate, for the purpose of allowing the tyre to be got on and off the face-plate of the lathe; and a cross motion is also provided for regulating the cut. For this purpose a motion similar to that of the slide-rest of a lathe is considered the most convenient,—a fast and loose pulley being mounted on the same shaft with the cutter for giving motion to the same.

The patentee claims the turning and boring the outside and inner surfaces of railway tyres and wheels, when cold, by means of revolving circular cutters.

The fourth part of the invention consists in three different modes of manufacturing and constructing railway axles. Fig. 21, shews a section of a compound hollow railway axle; the outer and thicker tube of which being first made, the smaller one is slipped into it, and the ends, for about eight inches, are then welded together: by this means an axle, with great elasticity of material to resist vibration and rigidity of section, is obtained. Fig. 22, represents an axle, the outside tube of which being formed, the bars, of the shape therein shewn, are piled together, and, without being welded, are pushed tightly through the outside tube, and then welded together, and also to the outside tube, for about eight inches at each end: of course the number and form of these bars may be varied as desired. Fig. 23, represents a section of the bars for forming a railway axle, so as to give a spiral direction to the fibres of the iron when the axle is complete: these pieces are welded together, either in rolls or under a hammer.

The patentee claims, First,—the construction and manufacture of a compound hollow railway axle. Secondly,—the construction of a hollow axle with the inside formed of bars welded only at their ends; and, Thirdly,—the method of arranging the bars of iron for forming an axle, so as to give a spiral direction to the fibres of the iron.—[*Inrolled October*, 1849.]

To MATTHEW KENNEDY, *of Manchester, cotton-spinner, for certain improvements in the method of packing cops of cotton and other fibrous materials, and in the apparatus connected therewith.*—[Sealed 3rd May, 1849.]

IN packing cops of cotton and other fibrous materials, it has been usual to place them, by hand, in a barrel, box, or basket (pressing them slightly as the packing progresses); and when a sufficient quantity of cops to fill, or more than fill, the recipient, has been piled up, the cops have been pressed into the barrel, box, or basket, in order that the head of the barrel, or the lid or cover of the box or basket, might be fastened in its place. By this means only comparatively small pressure could be employed; and cops so packed occupied a very considerable space, which, of course, increased the expense of freight, when they were sent abroad. Now, by this invention, not only can hydraulic or other powerful presses be employed, but the cops, being much closer and harder pressed, will occupy less space than heretofore; and cops so closely packed will not be caused to rub against each other by the motion of the ship, or other means of transport.

In Plate XIV., fig. 1, is a sectional elevation of the apparatus for packing the cops, as it would appear before beginning to compress the same; fig. 2, is another sectional elevation of the apparatus, exhibiting the packages of cops in a compressed state; fig. 3, is a sectional plan view of the press, with a bale of cops therein, after the ends of the pieces of hoop-iron, which surround the bale, have been rivetted together; and fig. 4, is an enlarged vertical section of the upper and lower angles of a bale, shewing the position of the parts of which the outer envelope is composed. The patentee states, that he prefers to employ an hydraulic press for compressing the cops, and he has shewn in the drawing the ram of an hydraulic press applied to that purpose; but any other powerful press may be used. In the ordinary mode of packing cops, only a small amount of pressure is exerted; and therefore the quantity packed into the barrel, box, or basket, only slightly exceeds that which the same would contain if the cops were loosely packed. Furthermore, no provision has been made for temporarily increasing the capacity of the barrel or other recipient, in order that a larger quantity of cops might be piled up and then compressed into the recipient; and the recipient or envelope for containing the cops has not been of such a nature as to admit of being compressed with the cops. Now, this invention consists in packing the cops in envelopes which can be compressed with the cops; and it also consists in temporarily increasing the capacity of the recipient wherein the cops are compressed, for the purpose above mentioned. The patentee prefers to employ the two parts of his invention in combination; but the latter part of it may also be employed in combination with the ordinary mode of packing cops.

Instead of packing the cops in bulk, as heretofore practised, the patentee first forms small packages of cops, and then combines a number of these packages to form a bale;—the object being to prevent the press remaining inactive for a considerable length of time, which would be the case if the cops were packed in bulk in the recipient of the press, hereafter referred to. The packages are formed in the following manner:—A rectangular bag of paper or other compressible material is placed in a box of a corresponding shape; the bag is filled with cops by hand, and the plunger of a press is caused to descend and compress the same; after which, the top part of the bag is pasted down, and the paste dried; and then the package is ready to be subjected to the action of the compressing apparatus, represented at figs. 1, 2, and 3.

a, is the ram of an hydraulic press, on the top of which is formed a recipient for the packages of cops, composed of two side-pieces *b, b,* and two end-pieces *c, d;* the side-pieces *b, b,* are strengthend by bars *e, e,* and are hinged to the end-piece *c;* they are connected to the end-piece *d,* by the bars *f, f,* which are made with hooked ends, to enter a recess formed for that purpose at *g;* and the hooked ends are retained in the recess by turning the nut *h,* and thus causing it to advance along the fixed screw *i*, and bring the disc *j*, into contact with the bars *f*, *f*. The recipient is guided in its ascent and descent by the pillars or standards *k*, *k*, which are embraced by the loops *l*, *l*.

The mode of employing this apparatus for packing the cops is as follows:—First the pieces of hoop-iron *m*, *m*, which are intended to bind the bale of cops after pressing, are placed in the recipient, and their ends are bent over the edges of the sides *b*, *b*; then a rectangular canvass bag *n*, (see fig. 4,) is placed in the recipient, and is retained in its proper position, against the sides and ends of the same, by means of a few small nails or tacks; after which a piece of bent iron plate *o*, is placed against the canvass bag, in each of the angles formed by the ends *c*, *d*, with the bottom of the recipient, in order to strengthen the corners of the bale of cops when completed; and then the bottom and the sides and ends of the bag are lined with thin boards *p*,—the boards being placed on edge with the grain running horizontally at the sides, and with the grain vertically at the ends. The recipient is now filled with the packages of cops; and a piece of iron plate *q*, is placed at the upper part of the bag, at each end, between the bag and the lining of boards. After this, four pieces *r*, *r*, are fixed above the pieces *b*, *b*, *c*, *d*, so as to enlarge the capacity of the recipient; and the space enclosed by the pieces *r*, *r*, is filled with packages of cops. When this has been effected, the capacity of the recipient is further enlarged by the addition of four pieces *s*, *s*; and the space, thus enclosed, is filled with packages of cops. On the top of the packages thin boards *t*, are placed; upon the boards, at each end, an iron plate *q**, is laid; then over the whole a piece of canvass is laid; on which canvass the wooden chocks *u*, *u*, are placed; and between these and the part *v*, of the framing of the press, two transverse chocks *w*, are interposed.

The press is now put in operation, and the packages of cops compressed until the upper surface of the same is level with the upper edge of the pieces *r*, *r*; when this has been effected the press is stopped, and the pieces *s*, *s*, are removed; after which the press is put in action again, and the packages compressed until the upper surface of the same is level with the top of the pieces *b*, *b*, *c*, *d*; and then the press is stopped, and the pieces *r*, *r*, are removed. The next operation is to pass the longest ends of the pieces of hoop-iron *m*, through the spaces between the chocks *u*, *u*, and to rivet them to the shortest ends, so as to securely bind the bale of packages; after which the pressure is relaxed, and the piece of canvass on the top of the packages is sewn to the edges of the canvass bag; and then the bale of cops is removed from the recipient by opening one of the sides *b*, as indicated by the dotted lines in fig. 3.

The patentee claims, as his invention, the means, above explained, of packing cops of cotton and other fibrous materials.—[*Inrolled November*, 1849.]

To JAMES WILSON, *of Old Bond-street, in the county of Middlesex, tailor, for improvements in trusses.*—[Sealed 1st May, 1849.]

THIS invention consists in so forming a truss that the spring, after ascending from the front pad, passes above and rests on the hip of the wearer, and then, descending below the top of the hip, terminates at the back of the wearer;—the object being to permit greater freedom of action, without liability to derangement, and without allowing any escape of the hernia.

In Plate XIV., fig. 1, is a side view of the body of a person, to which the improved truss is applied; fig. 2, is a back view thereof; and fig. 3, is a front view of the same. *a*, is the front pad, constructed in a similar manner to the pads of ordinary trusses, and varying in form according to the nature of the hernia. *b*, is the spring or elastic part of the truss, which is made of steel, and carries at its front end the pad *a*: this spring, up to the point where it passes above the hip, does not materially differ from the like part of a common truss; but, beyond this point, it is curved over the hip-bone, and then descends a short distance and passes behind the wearer. By this means a truss may be made, the form of which will not be discernible outside the dress; and such truss will admit of great freedom of the limbs, and enable the wearer to participate in active exercises without altering the position of the truss; and, in the event of a fall, no injury will arise to the wearer through want of efficiency of the truss. *c*, is a belt or elastic spring-strap for suspending the truss in its proper position: this belt or strap is not claimed separately; and other means may be adopted for sustaining the truss in its place.

The patentee does not confine himself to the details above given, so long as the peculiar character of his invention be retained. He claims the improvements in the manufacture of trusses above described.—[*Inrolled November*, 1849.]

To William Phillips Parker, *of Lime-street, in the City of London, Gent., for improvements in the construction of piano-fortes,—being a communication.*—[Sealed 15th May, 1849.]

This invention consists in changing, at will, the tone of piano-fortes, by the application of weights or heavy pieces of metal upon the strings thereof, at the part where they pass over the bridge of the sounding-board, or by pressure on the sounding-board otherwise obtained.

In Plate XV., fig. 1, is a plan view of a square or horizontal piano-forte, from which the top part has been removed; and fig. 2, is a vertical section thereof. *a*, is the sounding-board; *b*, is the bridge thereof, over which the strings *c*, *c*, are extended; and *d*, *d*, are the weights, which are designed to press upon the bridge when required. Each of the weights *d*, is affixed to a stem, which passes through the front and back bars of the frame *e*, and is secured by a nut; and the back bar of this frame is provided with pivots, which turn in suitable standards *f*, *f*, so as to admit of the weights *d*, rising or falling, as may be desired. *g*, is a rod, which descends from the frame *e*, and rests on one end of the lever *h*; and the other end of this lever rests on the rod *i*, connected with a pedal *j*. In the ordinary course of playing on the piano-forte, the frame and weights are kept elevated by a spring at *k*, pressing upon the longest end of the lever *h*; but, when it is desired to allow the weights to press upon the bridge, the longest end of the lever *h*, is raised (by acting on the pedal *j*, with the foot), and the other end, with the rod *g*, and frame *e*, consequently descends.

In the above arrangement, the pressure is produced by the use of weights; but weights are not absolutely necessary, as substitutes for them may be made of wood and other material, and the pressure effected by a spring below, or by the pressure of the foot on the pedal. The patentee states, however, that, to secure equal and uniform pressure, and a corresponding effect upon the tones of the instrument, he considers the weights, arranged according to the plan above described, to be best; nevertheless, he does not limit himself to the number of weights shewn; neither does he confine himself to the application of weights to the bridge *b*; he merely adopts this plan because he believes it to be the most convenient way of producing pressure upon the sounding-board, of which the bridge is an integral part; but he proposes, when circumstances render it more convenient, to apply the weights direct to the sounding board, near the place occupied by the bridge. He does not limit himself to the mechanical arrangement, above described, for supporting, raising, and depressing the weights.

He claims the application of weight or pressure on the sounding-board of the piano-forte, either indirectly upon the crooked bridge thereof, or directly upon the sounding-board itself (whichever plan may, in the end, prove the most convenient mode of applying the said weight or pressure to the sounding-board) for the purpose of producing a change in the tone of the instrument,—thereby extending its musical capabilities.—[*Inrolled November,* 1849.]

To GEORGE SIMPSON, *of Newington Butts, chemist, and* THOMAS FORSTER, *of Streatham, manufacturer, for improvements in manufacturing or treating solvents of India-rubber, and of other gums or substances.*—[Sealed 26th April, 1849.]

THIS invention consists, firstly, in a mode of manufacturing chloride or bichloride of carbon, and employing the same for dissolving India-rubber, gutta-percha, and other gums, or gum resins, or substances which are not soluble in water,—thereby obtaining new solutions of these substances; and, secondly, in a mode of treating coal-oil, in order to render it better applicable as a solvent.

The apparatus employed in carrying out the first part of this invention is represented in Plate XIV. *a,* is an iron still, provided with a steam-jacket *b*; it is connected, by the pipe or beak *c,* with the stoneware vessel *d,* which is heated by means of a steam-jacket *e*; and the vessel *d,* is connected with the worm *f,* contained in a worm-tub *g.* The still *a,* is charged with bisulphuret of carbon, and the vessel *d,* with pentachloride of antimony; steam is then admitted into the jackets; and the vapour of the bisulphuret of carbon is thereby caused to pass through the pentachloride of antimony into the worm *f,* where it is condensed; and from thence it runs into a suitable receiver. The product is rectified with lime in an ordinary still,—the resulting compound being a chloride of carbon, which is a sweet and uninflammable solvent of India-rubber, gutta-percha, and other gums and resins. The proportions in which the above materials are to be used are, one part, by weight, of bisulphuret of carbon to eight parts of pentachloride of antimony. In the above operation the whole of the available chlorine is absorbed from the antimony; and the latter is to be re-saturated with chlorine in the usual manner, so as to render it again serviceable. The product, above mentioned, may be used as a solvent to some extent without undergoing the process of rectification with lime; and by immersing India-rubber therein, or in the vapour thereof, the India-rubber is rendered less liable to be effected by cold or heat. The bichloride of carbon is to be used for dissolving India-rubber, gutta-percha, or other gums or resins, in the same manner as the ordinary solvents are employed.

The apparatus for treating coal-oil, according to the second part of this invention, is similar to that above described; but the vessel *d,* and worm *f,* are made of lead. The still *a,* is charged with coal-oil (which is preferred to be first purified by any of the usual processes), and the vessel *d,* is charged with a solution of chloride of lime. Steam is admitted into the jackets *b,* and *e,* and a jet of steam is introduced into the still; and then the vapour of the coal-oil passes through the vessel *d,* into the worm *f,* and is condensed. The proportions of chloride of lime and coal-oil which the patentees prefer to use are, one part, by weight, of chloride of lime, dissolved in water, to from fourteen to sixteen parts, by weight, of the coal-oil.

The patentees claim, Firstly,—the manufacture of chloride or bichloride of carbon, and applying the same for dissolving India-rubber, gutta-percha, and other gums or gum resinous substances, not soluble in water,—thus obtaining new solutions of these substances; and also acting on India-rubber, as above explained. Secondly,—the treating coal-oil with chloride of lime, as above described.—[*Inrolled October,* 1849.]

To John Barsham, *of Chelmsford, in the county of Essex, manufacturer, for improvements in separating the fibre from cocoa-nut husks.*—[Sealed 26th April, 1849.]

The first part of this invention consists in the employment of crushing-rollers for partially separating and for facilitating the complete separation of the fibres of cocoa-nut husks.

In Plate XIV., fig. 1, is a vertical section, and fig. 2, is a back view of the crushing apparatus. The crushing-rollers *a, a, a, a,* are preferred to be made with grooved surfaces; and they are caused to revolve with different surface speeds by gearing them together with cog-wheels *b, b, b, b,* of equal diameters, while the rollers are of different diameters. The rollers act to crush and drag the husks, and thus partially to separate the fibres; the number of rollers employed may be varied; and they are used to crush the husks both in the dry and wet state. The hard point or end of the pieces of husks is first to be chopped off; and then the pieces are passed between the rollers, by placing them on the table *c*, and pressing them towards the rollers, which press or crush the pieces of husks, and, at the same time, drag the fibres, by reason of the different surface speeds of the two rollers constituting each pair. After the pieces of husks have been passed once or oftener through the crushing machine, they are put into water and allowed to remain therein for two hours, or until they are thoroughly soaked; and then they are passed again between the rollers *a, a,* which should be set closer together than in the first instance. The patentee says, he is aware that it has been before proposed to employ rollers with rough surfaces, but revolving in opposite directions, so as to cause the pieces of husks to revolve on their own axes, for the purpose of rubbing out the matter connecting the fibres in the form of dirt: he does not, therefore, claim rollers when so revolving in opposite directions.

The second part of this invention consists in submitting the fibres to the action of rotating combs, or surfaces set with teeth. Fig. 3, is a partial longitudinal section of the apparatus, which is divided into three compartments, each containing a roller or cylinder *d*. The first and second rollers are covered with teeth (the form of which the patentee does not confine himself); and in front of each of these rollers there is a rest *e*, capable of sliding to and fro. The workman, holding a piece of cocoa-nut husk, places it on the rest belonging to the first roller, with its end projecting over the same; and he gradually presses forward the rest, and thus advances the piece of husk towards the roller, so as to remove the fine tuft of fibres from the interior of the stalk end of the piece of husk. The piece of husk is then submitted to the action of the second roller by the next workman, who holds one end of it towards the roller until the fibres of that end are well combed out; and then he turns the other end and causes the fibres of the same to be combed out;—the middle portion being only partially combed. The piece of husk is then passed to the next workman, in order that it may be operated on by the third cylinder or roller, which is covered with strong wire card teeth: the workman, at this cylinder, holds the piece of husk by the ends of the fibres, in such manner that the teeth of this cylinder may penetrate and comb out the middle portion of the fibres, and thus complete the combing operation. The fibres are subjected to the combing process when in a moist or wet state.

The patentee claims, Firstly,—the partial separating of the fibres of the husks of cocoa-nuts by passing pieces of the husks through rollers, both in a dry and wet state, as above explained. Secondly,—the combing out the fibres of the husks of cocoa-nuts, by causing them to be acted on by rotatory combs when held.—[*Inrolled October*, 1849.]

To JOHN HORSLEY, *of Ryde, in the Isle of Wight, practical chemist, for certain improvements in preventing incrustation in steam and other boilers; also for purifying, filtering, and otherwise rendering water fit for drinkable purposes.*—[Sealed 26th April, 1849.]

THIS invention consists in certain improvements in treating water, for the purpose of preventing incrustations or deposits in steam and other boilers; and also in purifying, filtering, and otherwise rendering water fit for drinkable purposes.

In order to prevent incrustations or deposits in boilers, the water intended to be used is first purified in the manner hereafter described with regard to water designed to be employed for drinkable purposes; and when sea-water is to be used for generating steam, such water is purified in a similar way by the employment of oxalate of potassa and ammonio-phosphate of soda: the proportions adopted for the water of the British Channel are, two drachms of oxalate of potassa and two ounces of ammonio-phosphate of soda for every gallon of water; but these proportions may be varied. The precipitate resulting from the use of these substances forms a good fertilizer for wheat and other grain; and therefore it need not undergo decomposition, as in the cases hereafter mentioned.

With regard to purifying and otherwise rendering water fit for drinkable purposes, the patentee remarks that all water, except that which has been distilled, is more or less charged with adventitious matters (earthy, saline, and gaseous) which impart to it the objectionable property of "hardness." Now, it is well known that there are certain chemical materials, tests, and re-agents, which will indicate the presence or absence of the adventitious matter, forming therewith insoluble precipitates; and it is the object of this invention to extend and apply this knowledge to the separation of the earthy and saline adventitious matters from the water;—such separatio being conducted on the principle of either single or double elective chemical affinity; or, in other words, by a system of displacement, based on the nature and theory of chemical equivalents, or the knowledge of the parts and proportions in which the several substances unite and become held in solution.

To effect the separation of the calcareous matter from water, the patentee uses such substances as are capable of decomposing the same; viz., calcined or caustic barytes, or a solution of the same in water, known as baryta water (the baryta, uniting with the excess of carbonic and sulphuric acids of the salts of lime, decomposes and precipitates the same along with the lime, in the form of carbonate of lime, carbonate of barytes, and sulphate of barytes); also phosphate of soda (the phosphoric acid of which unites with the lime to form the insoluble precipitate of phosphate of lime); silicate of potassa (the silicic acid of which unites with the lime and forms an insoluble silicate of lime); oxalic acid and its soluble alkaline salts, oxalate of soda, oxalate of ammonia, oxalate of potassa, and sesqui-oxalate or binoxalate of potassa (which substances unite with the lime and form a precipitate of oxalate of lime); and caustic strontia or strontia water.

As the object of this invention is to purify and soften hard water, which is of a very variable character, it is necessary, before treating any water, to ascertain the character or hardness thereof; and this the patentee effects by treating a given quantity of water with an excess of oxalate of ammonia or oxalate of potassa (say two drachms of the oxalate to a gallon of water), so as to precipitate the adventitious matter or lime to the fullest extent. For every gallon of this precipitate, when dried, an equal quantity of crystallized oxalic acid is to be used, in order to purify the water: thus, if a gallon of water yields in this way fifty-six grains of precipitate, fifty-six grains of the acid should be used along with an equivalent of potassa; then there will remain in the water, after precipitation, instead of and in the place of the lime so displaced, a carbonate, muriate, or sulphate of potassa, as the case may be; and the water is purified and fit for use. In all cases the adjustment of the relative proportions of the materials to be employed for purifying the water must depend upon the character of the water; and it is necessary to guard against any indiscriminate use or excess of the materials, in order to avoid communicating any noxious qualities to the water. To ascertain the presence or absence of any residual oxalic acid more than is necessary to effect the decomposition of the various earthy salts, the patentee adds to the purified water a small portion of lime-water; and then, if turbidity ensues, he determines whether a carbonate or an oxalate of lime has been formed by the application of acetic acid, which will dissolve carbonate of lime, but will not act on oxalate of lime. To ascertain if barytes or its compounds be present, a few drops of dilute sulphuric acid or a little sulphate of soda may be employed—even carbonate of potassa or soda will throw down the baryta. When the other substances are used, no test is required, as the residual matter is harmless.

For filtering the water any of the ordinary filters may be used; but in general the water will be so thoroughly purified by the above treatment as to render filtration almost unnecessary. The clear water may be drawn off, after the subsidence of the precipitate, by means of a syphon combined with an exhausting syringe, as represented in Plate XV., where *a*, represents a cistern, tank, or reservoir, in which the water has been treated in the manner above described; *b*, is a syphon, one leg of which dips into the water in the tank (terminating at a point above the precipitate), whilst the other leg descends outside the tank and is connected, near its extremity, with a syringe or air exhauster *c*, by means of the short pipe *d*. The air is first exhausted from the syphon by means of the syringe *c*; and then, the cock on the outer leg of the syphon being opened, the purified water is drawn off into any suitable receiver. In order to recover the materials used in the process of purification, the precipitate (after removal from the tank) is cautiously treated with an excess of aqueous sulphuric acid, which decomposes the oxalate of lime; and, on dilution with water, the oxalic acid is taken up in solution, which, being filtered and evaporated, yields crystals of pure oxalic acid. Or the precipitate may be boiled with a solution of carbonate of potassa; and then, by filtration and crystallization, oxalate of potassa will be obtained—insoluble carbonate of lime being left on the filter.

The patentee claims, Firstly,—the treating sea-water with a view to prevent incrustations or deposits in marine boilers, by the means before mentioned. Secondly,—the treating ordinary water, whether with the view to prevent incrustation in steam and other boilers, or for purifying and rendering it drinkable, so as to soften and deprive it of adventitious matters.—[*Inrolled October*, 1849.]

To Lemuel Wellman Wright, *of Chalford, in the county of Gloucester, civil engineer, for certain improvements in preparing various fibrous substances for spinning, and in machinery and apparatus connected therewith.*—[Sealed 30th January, 1849.]

This invention relates to the preparation of flax, china-grass, and similar fibrous substances for spinning; and it consists in a peculiar mode of separating the fibres more minutely and with less labor and expense than heretofore.

Flax and similar fibrous materials have been hitherto prepared by the processes termed scutching and heckling, in which considerable waste takes place; but, according to this invention, the process of preparation is carried on in a steam-tight vessel, and the preparation of the fibrous materials is completed without removing them from the vessel or deranging them, so that when taken from the vessel they will be straight and free from matting: this is of great importance in operating upon fibrous substances when different solutions of alkali and water are to be employed for dissolving the gummy and vegetable coloring matter. The figure in Plate XIV., is a sectional elevation of the apparatus. *a*, is a steam-tight vessel, in which the process of preparing the fibrous material is to be carried on; *b*, is what is termed an auxiliary vessel; *c*, is a pipe that connects the vessels *a*, and *b*; *d*, is a pipe for introducing steam into the vessel *a*; *e*, is a pipe for introducing water and alkaline solutions into the vessel *b*; *f*, is a cock for discharging air from that vessel; *g*, is a cock for discharging air from the vessel *a*; *h*, is a pipe for drawing the alkaline solutions and water from the vessel *a*, and for blowing steam through the fibrous materials, in order to dry and separate the fibres; *i*, is a pipe for admitting steam into the vessel *b*, so as to cause the alkaline solution or water to boil and flow through the pipe *j*, into the vessel *a*, where it falls on the plate *k*, which is perforated for the purpose of distributing the solution or water; *l*, is a perforated false bottom; and *m*, is a hollow cylinder, attached to the false bottom, and enclosing the rod *n*, which is used for the purpose of lifting the false bottom and the fibrous material from the vessel *a*, after the operation is finished.

The fibrous material is first steeped in cold water for twenty-four hours; then the water is to be drawn off, fresh water substituted, and the temperature kept at 90° Fahr., for another period of twenty-four hours; after which the flax or other fibrous material will be ready for packing in the vessel *a*. When the fibrous material has been packed in the vessel *a*, the cocks on the pipes *c*, *e*, are to be opened, the cocks on the pipes *d*, *h*, closed, and the cocks *f*, *g*, opened: the alkaline solution is allowed to flow through the pipe *e*, into the vessel *b*, and through the pipe *c*, into the vessel *a*, until it stands at the height indicated by the dotted line *o*, *o*, in the vessel *b*, and at the same height in the vessel *a*; then the cocks *f*, *g*, are closed, and the cock on the pipe *i*, is opened, so as to admit steam into the vessel *b*, and thereby cause the alkaline solution to boil and flow through the pipe *j*, into the vessel *a*; and, after penetrating through the fibrous material, the alkaline solution returns to the vessel *b*, through the pipe *c*. The boiling operation is kept up, until the alkaline solution is spent; and then it is to be drawn off by the pipe *h*. The patentee here states that the strength of the alkaline solution (made from soda-ash), when operating on flax, stands about No. 6 hydrometer; and this solution is to be repeated, if required, according to the quality of the flax; but when china-grass is being operated on, the solution is made with crystal soda of less strength, not with soda-ash. In order to draw off the spent solution, the cocks on the pipes *d*, *h*, are opened, and steam is allowed to pass through the mass until the whole of the solution has been discharged through the pipe *h*; and then clean soft water is to be introduced and caused to circulate through the fibrous material in the same manner as the alkaline solution, until all the alkali is removed from the fibres. After the fibrous material has been washed with the water, high-pressure steam is to be caused to pass through the fibrous material (by opening the cocks on the pipes *d*, and *h*, and closing all the other cocks), until the same is nearly dry; then the top of the vessel *a*, must be taken off, in order to admit of the withdrawal of the fibrous material, which will be nearly dry and separated; and, when completely dry, it will be in a condition to be made into slivers or rovings, and spun.

The patentee states that, when operating on china-grass, he finds it desirable to use soap with crystal soda, so as to form a strong lather, to operate on the fibres; but, in other respects, it is operated on in the same manner as flax and similar fibrous materials. He prefers to finish the drying in the open air, upon the grass; but he does not confine himself thereto.—[*Inrolled July*, 1849.]

Scientific Notices.

ON THE MEANS OF DEVELOPING OUR NATIONAL INDUSTRY.

That man is a progressive being is a fact which both statesmen and philosophers admit in theory; but, in practice, the former certainly deny it; for they are too often found endeavouring to rule, as if precedent were their sole guide, or fate their stern dictator. Yet, with this experience before our eyes, we are accustomed, as a nation, to pride ourselves on the march which civilization is making in the world through our exertions; forgetting, at the same time, that we are voluntarily supporting and encouraging a great central power, which is most frequently engaged in retarding our desired ends: for seldom is any improvement effected until forced upon the government by "the pressure from without." It may be well, perhaps, for some reasons, that a skid is thus put upon the wheel of reform; but it is, nevertheless, evident that Great Britain has large advances to make in home civilization, while remediable evils are left unredressed, and, in many cases, their removal is not attempted to be effected. The degree of civilization of a country can only, we think, be justly determined by the amount of development which the human consciousness has received in that country: thus, where the moral and physical wants of the people are most cared for, there must civilization have attained its highest growth;—the cultivation of science and the fine arts is no sure guide,—for they have flourished, more or less, in all states of society but the most primitive. Few periods have been so well calculated to enlarge our views of the duties of social relationship as the last three years. We have but just recovered from a pestilence, which it would seem, neglect of sanitary measures, if it did not create, has, at least, considerably augmented; and that was preceded by a trouble of far more fatal consequence to Europe—produced, as is now clearly ascertained, by a disregard on the part of the rulers, of the severe and wide-spread distress among the working classes; many of whom, from want of honest employment, were scarcely able to find a bare subsistence, and were thus driven to try what revolution and rapine would produce. The fearful example which Paris recently presented of a demoniacal, and well nigh successful, attempt to subvert all order, brought to the remembrance of the thinking part of the community of Great Britain, the fact, that thousands, in this country, had little to lose from the failure of a revolutionary movement, and much to hope from its success. Reflections upon this subject, which, at the time, formed a leading topic in the daily and weekly journals, produced something like a general acknowledgment that some means should be adopted to provide employment for the industriously inclined; but, further than awakening the national consciousness in this particular, nothing has resulted; nor is it probable anything will be done to improve the prospects of that laboring community, of which we have just reason to be proud, until another and severer season of distress produce a pressure from without, which cannot be resisted with impunity. In this matter, as with all others requiring reform, nothing can be effected in the proper season—when there is time for calm consideration; but the change must take place when we are either smarting under the wound, or have scarcely recovered from the severity of the blow which our own neglect has brought down upon us. There is, perhaps, nothing of greater national importance, whether as affects our financial prosperity or the stability of the empire, than that of providing profitable and continuous occupation for the ever-increasing numbers which make up what is termed—"the laboring classes." Yet, so far from attempting this, the legislature has, in indifference to what is now tardily begun to be acknowleged as a duty, allowed ignorant workmen to tyrannize over their fellows by means of Trades' Unions, which have invariably tended to depress the class they were intended to benefit; and not only so, but rapacious peddling money-lenders have been permitted to practise their arts upon the industrious poor after an organized system, bearing the specious name of *Loan Societies.* Hitherto it has been by private enterprise alone that new fields of industry have been developed in Great Britain; and, when contrasted with the system pursued in France, where the central government is the great moving principle, it would seem that ours is the better plan;—but the duty, as we conceive, of a government, is neither wholly to disregard the causes of commercial distress, nor to enter into ruinous competition with individual exertions; for, in the one case, disaffection and disorder must ensue; while, in the other, the spirit of enterprise would be extinguished. There is, however, a middle path, which no government has ever yet systematically pursued,—and that is, to take the lead in doubtful enterprises, where the benefits, if success were attained, would become national; but into which, a private speculator would scarcely like to venture, from the fact that his dear-bought experience would be as available for the benefit of others as for himself. Of new and plausible schemes, for developing the resources of the country, there is no lack; and, of some of the most tangible of these proposals, it would be well for the government, by a full and searching investigation, to ascertain how far they might be depended upon as theoretically correct; and, of such as were approved, a frugal expenditure might be advantageously made, to test the grounds for their ultimate success. When contemplating the distress which a want of profitable employment entails upon the laboring classes, the mind will naturally turn to Ireland, as the land where the suffering, from this cause, is most fearfully realized; and a hope of improvement, if it should arise, will readily be dispelled by the memory calling up the reasons for this destitute condition of the people. Towards the close of the last session of parliament a few sanguine men in the House of Commons were bold enough to express their conviction that a vast field for industry had at last been discovered for the poor Irish peasantry, by the conversion of their bogs into a variety of valuable products; yet, although the public was but too glad to greet this announcement as a genuine ray of hope, the gleam of sunshine has paled away, at least for the present; and the bogs are still allowed to germinate, undisturbed, over three millions of acres, or one-seventh of the whole area of Ireland, and occasionally to move beyond their boundaries, and carry desolation over the neighbouring cultivated plains. If no reasonable grounds at present existed for supposing that peat could be made commercially important, yet, arguing from analogy, one might fairly come to the conclusion that these vast morasses, pregnant, as they are, with vegetable life, were capable of yielding some valuable product; for the progress of discovery continually strengthens the opinion that all matter contains some element or substance which may be made subservient to the wants of man: the partial cultivation, too, of bog lands in England and Scotland clearly demonstrates that there is an extensive untried field for the application of peasant labor, at least. Here, then, is a case in which the government might fairly take the initiative; for the question to be determined, is not as to the value of the land when reclaimed, and to the probability of its permanently supporting so many thousand farm servants; but rather in what way that spongy vegetable matter, at once the type and cause of sloth—that moral incubus of Ireland—should be treated, to pay the expenses of its removal and after preparation: this is essentially a national question, and, as such, especially in the present state of Ireland, it should be regarded. There are many facts connected with peat that are already ascertained, viz., that, by distillation, it will yield charcoal, tar, ascetic acid, pyroxilic spirit, and paraffine (a kind of tallow); but little or nothing is known of the commercial practicability of thus converting peat. Now, as the manufacture, if really worth pursuing, must necessarily be an open one, it is scarcely fair that experiments, to determine this point, should be instituted at the cost of private enterprise; yet such, we doubt not, will be the case, if the subject is ever taken up, and, perhaps, to the ruin of the first projectors. We would, however, hope better things for the benefactors of mankind in this age than frequently befell them at an earlier period; for it would be a disgrace to the present era if a second Sir Hugh Middleton were to meet with a similar fate, from his philanthropic exertions.

As respects the preparation of peat, there are many schemes already before the public; and, of these, the one put forward by Mr. Jasper Rogers, under the auspices of the "Irish Amelioration Society," appears to be well worthy of notice. The broad features of his plan are, to manufacture peat into charcoal, and simultaneously, by applying the radiating heat of the incandescent charcoal, to effect the perfect dessication of partially dried blocks of peat; and thus to prepare a cheap fuel, suitable for ordinary purposes. Now, in the successful prosecution of all schemes of this nature, it is not merely necessary to manufacture an article which, on an elaborate calculation, may be found to be equal, in point of economy and utility, to a substance already in general demand; but it must be shewn to possess some essential advantage over the article with which it is brought into competition, before a market can be obtained for it at the expense of the article already in use; and this is exactly the position in which peat fuel stands with regard to coal. That peat charcoal, by its freedom from sulphur, would, if used in the blast furnace, produce a better quality of iron than can be obtained by employing coke, there can be no doubt; but then come the questions as to the cost per ton of the charcoal, and its power to resist the action of the blast. It is obvious that neither of these points admit of ready solution, for they both depend upon the density of the charcoal. Any density may be, however, obtained at an increased cost; but then that extra cost may preclude the possibility of using the charcoal in the smelting and manufacturing of metals. The same difficulty arises with respect to the application of dried peat as a fuel; and a lengthened experience in manufacturing and in using it, will alone determine its real value. It is encouraging, therefore, for those who look to the conversion of the peat bogs, as the means of regenerating Ireland, to find that another point in Mr. Rogers' scheme is not so dependent on probabilities: we allude to the use of granulated charcoal as a manure. Experience has shewn that the success of this application will depend solely upon the price at which the charcoal can be sold; for not only is it calculated, *per se*, to enrich the soil, but it possesses the peculiar property, when combined with animal excrement, of absorbing the ammonia and rendering it perfectly inodorous; and of so diluting (if such a term is allowable) this the most valuable of all manures, as to render it fit for immediate use on arable and pasture land; whereas, according to the present practice, vegetable matters (which take a long time to decompose and become fit for manure) are mixed with the excrement, and the ammoniacal gases, in consequence of the long exposure of the manure to the air, are completely evolved and lost. According to the statement of the Irish Amelioration Society, the public may be furnished with charcoal at £1. 1*s.* per ton; which is a price calculated to create a large demand, both for sanitary operations and for farming purposes;—it remains, however, to be seen how far experience will warrant them in redeeming this promise. In the meanwhile we are assailed with counter statements, which deserve consideration. These are to the effect that, charcoal being the only product which the Society proposes to obtain from the peat, the whole cost of cutting, piling, and drying, must be laid upon it;—that these operations are exceedingly costly, and that, however well the expenses may be borne by the peat, when rendered fit for the ordinary purposes of fuel, yet, upon a ton of charcoal, they must be quadrupled—inasmuch as it requires four tons of dried peat to produce one ton of charcoal,—and therefore the charcoal cannot possibly be sold at the price stated. It is thought essential, by the objectors to the Society's adopted system, to make some other of the component parts of the peat available; and thus to carry on, at least, a double manufacture, viz., the distillation of the tar simultaneously with the burning of the charcoal. Several plans for effecting this have already been proposed, and made the subject of letters patent. Of these, our present number contains one, by Mr. Green, who, in addition to obtaining charcoal and tar by the destructive distillation of the peat, collects the inflammable gases driven over with the tar, and returns them to the furnace, to be used as a fuel. Now, if, in addition to 25 per cent. of charcoal obtained from the peat, 20 per cent. of tar (the amount which is usually given out), of a marketable value, be produced at but a slightly increased cost, the prospect of dering peat charcoal a staple commodity of trade will tly improve; and exactly in proportion to the increase in market price of this mixed product of distillation, or the ease in the cost of producing, will be the stability of the peat charcoal manufacture. It is not our intention, in this paper, to gainsay the statements of any party, and much less to advance one project by the depreciation of another; our object is simply to consider how far the public may be warranted in indulging in the prospect of a new field of labor being opened out to the country by the conversion of the peat bogs of Great Britain. If charcoal can be produced and sold at a profit for £1. 1*s*. per ton, there is little doubt that it will immediately supersede the use of guano at from three to five pounds per ton; and that a large and constant supply will be required; but, beyond this, there is the prospect of its becoming employed in the manufacturing and working of metals, —the application to which purposes would ensure the employment of a large number of hands in cutting and preparing the peat. Should it, however, be found that Mr. Rogers' plan is too costly to ensure the introduction of a low-priced charcoal into the market, there is yet the hope that some other of the many proposed plans may be more successful in forming a basis for the development of this new branch of industry. From the want of reliable data the whole of this question is, at present, necessarily involved in doubt; and any opinion, therefore, upon its merits can only be formed upon hypothetical grounds. For instance, the mercantile value of the essential oil and tar obtained by the distilling process, at whatever sum it may be put, is wholly suppositious, and will depend entirely upon the purposes to which it is found applicable. If, as is supposed, it will be useful for saturating timber, it may fetch a good price; and thereby allow the manufacturer to sell his charcoal at a reasonable rate; but, if no demand can be created for the tar, it will then be a matter for consideration whether or not the distillation shall be continued, to obtain the pyroxilic spirit, the paraffine, or the acetic acid, from the tar,—and thus prepare some article already possessing a commercial value. It is obvious that any efficient means which may be suggested for cheaply extracting or beneficially applying these substances, will tend to promote the more general employment of the laboring classes; we should, therefore, hail with satisfaction any improvement that might be suggested to this end, whether it came in the form of bog-tallow candles (as proposed by Mr. Reece), as a saturating solution for timber, a new preparation of manure, an artificial fuel, or in whatever other shape the skill of man might devise. That good to the community will eventually result from the manufacture of peat we have little doubt; but we fear the chance is small that the government will assist in developing this important (if successful) branch of industry;—

there is yet, however, a power on which we can rely, although, from lack of sufficient inducement to proceed, it may at first be tardy in its operations,—and that is, the spirit of individual enterprise, which has hitherto accomplished so much in this country. To such, then, as have the means of furthering this object, we would urge the consideration that every honest enterprise is capable of furnishing a double incentive to activity; for, as evil cannot be committed without others than the actor participating in the injury which it entails; so, to the projector of a good work, individual success cannot be attained without others connected with the enterprise being likewise benefited. And what can be more gratifying to any man than thus to share his fortune with the industrious poor?

ON THE ARTIFICIAL COLORING OF CORNELIANS, CALCEDONIES, &C.

The number of stones, known to the ancients by the term gems, was much greater, and the stones much more various, than those classed by modern connoisseurs under that name. Among those called gems or precious stones, at the present time, we find only a very limited number; and these we distinguish by their color, transparency, brilliancy, hardness, and, above all, by their extreme rarity. The ancients regarded as gems an immense number of stones which were of a pleasing color and fine texture; no matter whether the tint were uniform or brilliant, or whether the stone were marked with zones or clouds of different colors; at the same time stones finely marked by zones or ribbons of bright color were considered more valuable than those which were of a single and uniform tint: stones of both classes were, however, particularly valued in remote times, inasmuch as they offered to the hand of the engraver an admirable material for his art; but those most variegated were most highly esteemed, as they were suitable for objects engraved in relief; that is, for the production of cameos:—thus it is related, that the most valuable of all the stones of this description was the variegated quartz, a kind of gem, which sometimes presented such an extraordinary natural mixture of colors that the stones were regarded with great wonder and curiosity; and Pliny makes mention of a specimen of agate, in which, in the natural markings of the stone, could be distinguished a representation of Apollo and the nine Muses.

The high value attached, in ancient times, to gems, particularly to those which had been engraved by skilful artists, will shew us why, at that epoch, the art of producing factitious copies of genuine stones, or of enhancing the beauty of the latter, was one assiduously cultivated; and, according to the statement of Pliny, this was in his time not an unprofitable species of fraud. Artificial stones were then produced from different kinds of fusible glass; thin laminæ of stone were cemented together to imitate the peculiar color and appearance of certain kinds of gems, such as the agate or onyx; transparent stones were cemented together with interposed thin sheets of bright metal; and the natural colors and markings were modified or heightened by a variety of manipulations.

Among the various processes employed by the ancients for the coloring of these gems is one described by Pliny; but which, up to the present time, has been generally although erroneously treated as a fable: this process consisted in boiling the stone with honey, during at least seven or eight days; and it is a curious fact that this identical process is still employed in the agate manufactories of Oberstein and Idar, for the purpose of converting calcedonies and red and yellow cornelian into fine onyx. This singular process remained, during many years, a secret in the possession of an agate merchant of Idar, who had probably purchased it from the Italian and Roman artists, that were in the habit of frequenting that locality to buy stones suitable to their art. The coloring of these stones is founded upon the following property:—The ribbons or zones in the different varieties of calcedony, which, in the kidney-formed masses of that substance, lie superimposed, differ in their texture and compactness; but, owing to their similarity of color in the natural state, they can only be distinguished from each other with difficulty. The stone is however capable of absorbing fluids in the direction of the strata; this property the strata possess, however, in differing degrees; therefore, if a colored fluid be absorbed, and the quantity taken up by the pores of the stone is different for every strata or zone, it is clear that a number of tints will be produced, corresponding to the number of zones, each of which will indeed be rendered distinct and colored in proportion to the quantity of coloring fluid it may have absorbed; thus, a specimen of stone naturally but slightly colored may, by this treatment, be rendered equal to fine stratified calcedony or onyx, and may be equally well employed with them in the engraving of cameos, or for any other purpose where the variety of color can be rendered available.

The signs of value in these stones, when in their rough state, are recognized by the merchants by an empirical test, which rests upon the above-mentioned property of absorption of liquids. In the trial a small piece is broken off that part of the rough stone which is expected to be of marketable value when polished: this fragment is moistened by the tongue; the buyer then remarks carefully the rate at which the moisture dries away; or, rather, whether it be rapidly absorbed by the stone; and also whether the absorption take place in alternate bands or zones, and in one zone more rapidly than in another. According to the greater or less rapidity of the absorption, the merchants judge of the aptness of the stone to receive color, and, above all, if it be likely to assume the appearance of onyx under the coloring process.

The artificial coloring of these varieties of stone is practically carried on in the following manner:—The stones about to be submitted to the coloring process are first washed with great care, and then equally carefully dried, but without exposure to an elevated temperature; when perfectly dry they are put into a mixture of honey and water,—taking scrupulous care that the vessel employed be clean; above all, that it be free from every kind of greasy matter: a fire is lighted beneath the vessel, and the fluid heated rapidly; but, at the same time, ebullition must not be permitted; and the fluid, lost by evaporation, frequently replaced, in order that the stones be constantly kept covered,—this is essential. The operation of the honey is continued for two or three weeks,—the time necessary being known only by experiment. When it is considered to be complete, the stones are removed to another vessel, and strong sulphuric acid poured upon them until they are covered. A slab of slate is placed over this second vessel, which is then put upon a furnace, and the sulphuric acid heated to 350° or 400°. At the expiration of some eight or ten hours, the stones are generally found to have acquired the requisite color,—that is to say, those that are at all capable of receiving this factitious coloring; for it will be found that some of the stones submitted to the operation will refuse the color entirely; indeed, in all, the effect varies very much. The larger and softer stones are finished in a few hours; but others require to be kept under the influence of the acid during the whole of a day. When finished, the stones are removed from the acid and thrown into water, where they are well washed, and then dried in a kind of oven;—they are next polished, and, afterwards, put into oil, where they remain for a day or two, according to circumstances. The oil removes from the surface of the stone the appearance of slight flaws or fissures, and imparts to it a high degree of polish and brilliancy. The oil itself is removed by rubbing the stone gently with bran. The chemical action, which determines the access of color in this process, appears to be very simple:—The honey penetrates into the porous layers of the stone, and is deorganized and carbonized in the pores by the sulphuric acid. The color of the bands, which absorb the honey, is thus more or less increased by the deposition of the carbon. The colors, which naturally were barely indicated by different degrees of transparency in the zones, become, by this treatment, grey, brown, or even almost black; whilst the white parts are rendered brighter and more distinct by becoming, under the influence of the high temperature, more opaque. This is also the case with the bands of red; so that, not only is color given where none previously existed, but even those parts that were originally colored acquire a brightness of tint and distinctness of marking much greater than that which they naturally possessed.

ON THE INFLUENCE OF BORACIC ACID IN THE PROCESS OF VITRIFICATION.

In an account of the Austrian Exposition of Arts for the year 1845, it was shewn by M. Peligot, of Paris, that in the manufacture of the pure and hard glass, almost peculiar to the glass works of Bohemia, the following materials are employed, and in the following respective quantities:—100 parts of silica, 12 parts of quick lime, and only 28 parts of carbonate of potash; whence it may be perceived, that glass, generally, possesses the qualities of hardness and infusibility in proportion as the lime is increased and the alkali diminished in quantity. The above proportions give a glass quite unmanageable in ordinary furnaces, on account of its excessive infusibility; but the addition of a comparatively small quantity of boracic acid is capable of determining fusion; and the result is, a glass having all the requisite limpidity at a high temperature, and possessing, at the same time, a great brilliancy and hardness.

This solvent property of boracic acid, if the term may be thus used, has also been applied in the case of infusible bases, as yet unemployed in glass-making, producing, for example, such compounds as the boro-silicate of potash and zinc, and the boro-silicate of potash and baryta;—these seem to be remarkably suitable to the manufacture of certain kinds of glass, which are found to be possessed of great purity and hardness.

It has also been a matter of experiment to substitute the potash by soda. The attempt has proved quite successful; and, although the soda-glass is somewhat inferior to that made with potash, it is, without doubt, superior to any other kind of glass in which soda is employed as the alkaline constituent. The most remarkable properties of the boro-silicates are, their hardness and perfect transparency;—these qualities seem to arise from the circumstance of the quantity of alkali being so much lessened: this ingredient is always present in excess in ordinary glass, which is, to a certain extent, soft and hygrometric, and, consequently, often becomes, after long exposure to the atmosphere, more or less nebulous.

As the boracic acid glass is eminently translucid and free from defects, and also so extremely hard, it becomes a question of great interest whether, at a future time, it may not be employed for optical purposes. For this object, it is probable that the denser bases, such as lead, bismuth, &c., may be employed, in addition to the lime and baryta, and in part substitution for them.

Ko Doü Dzu Roku, or, a Memoir on Smelting Copper, illustrated with plates. Small folio, pp. 20. [Translated from the original Japanese for Silliman's American Journal of Science.*]

THE *Ko Doü Dzu Roku,* which we present our readers in an English dress, is a thin pamphlet of twenty leaves, fourteen filled with plates and explanations written in the Japanese hirakana character, and six with Chinese writing. There is neither preface nor exordium to the work, which being a very commendable example, we shall follow, premising that throughout the translation the original is indicated by marks of quotations. We will, however, just add a record of our hesitancy in presenting this performance to our readers. The natives who have acted as our teachers are sailors or tradesmen, persons in ordinary life and of common education, and who in their own coun-

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* From the Chinese Repository, 1840.

try would probably have never attempted to read a book on metallurgy. They know but little more than how to read simple works or write mercantile letters.

Plate I. *Of digging the ore.*—This plate is in two compartments; the first represents a miner entering the mouth of the pit, carrying a lamp in one hand, and a pick in the other, with an empty basket swung on his back. At the entrance he meets a second miner just coming out with a basket of ore. The second shews the same person reaching the extremity of the mine, where is a third workman engaged in cleaving the ore from its bed.

This and all the succeeding plates are painted; the colors are everywhere laid on in an artist-like manner, though the cheapness of the work apparently forbade much labor.

"The copper, as it comes from the hills, is undoubtedly in the form of ore; the ore is the effluence of the copper, and in a serpentine vein it rises and appears upon the top of the hill. There are many sorts of ore; that which is of a reddish-black color, soft and not very heavy, and taken from veins running from east to west (or horizontally), is the best. The overseer of the mine examines and assorts the ore. Rafters, planks, joists, pillars, &c., are used to uphold and prevent the mouth of the mine from caving in. When commencing, the rock is worked with hammers and chisels; the [barren] stones are thrown away as they are dug, and the ore is brought out; by degrees the hill is penetrated, and the hole thus formed is called a mine. A lamp made of a shell is used as a light, and the quarried stone, put into baskets, is carried out on the back. Wherever the quarrying has been done, rafters, planks, and pillars are set up to restrain the overhanging rocks lest they fall. There are many kinds of both good and bad ore. When the mine has been dug deep, the air does not permeate it, and the lamp goes out; therefore, in places above the mouth of the pit, holes are cut down reaching to the mine, opening into it in many places, and secured by planks, rafters, &c.; they are called ***shyiaku hachi*** or flute-holes. Thus the wind is made to circulate. The whole is called *fuki mawashi* or wind ventilator."

Plate II. *Assorting the ore.*—This plate exhibits a company of women, with hammers in hand, pounding the ore, and separating the barren stone; one of them has her child strapped to her back. A copper tea-pot stands hard by, and one old dame is enjoying her pipe while plying her hammer.

"Among the ore there are both rich and poor kinds, combined with the plain rock; the poor is separated from the stone, which is then thrown aside, and called refuse stone. This is the employment of old men and women."

Plate III. *Draining the mine.*—In this plate, we have a section of one of the "flute-holes," and three lifting-pumps re- resented, emptying into each other by means of water-boxes laced on shelves cut in the rock, where also the laborer stands work the pumps. The lifting-pump is not known to the hinese, and we were not previously aware that the Japanese

were acquainted with it. How invaluable would be the gifts of a steam-engine to the Japanese miners, toiling day and night to raise water from the deep mine, and of a safety-lamp to him who now works by the light of a shell-lamp! The darkness or the depth of the mine is intimated by lamps placed near the pumps; and the painter has very cleverly represented the light proceeding from them by leaving a circle of white around the flame,—the surrounding rock being a light umber color.

"In obtaining the ore, as the mine descends deeper and deeper, and the digging is low down, the water bubbles up, making the labor difficult. Therefore wood and bamboo, prepared in pieces about thirteen feet long, are placed one above the other, and these tubes (or pumps) are inserted into water boxes; several tens or hundreds of strokes are required, according as it is deep or shallow. They are worked uninterruptedly, day and night, to draw the water to the surface. In this manner of operation, there is a great consumption of the strength of the workmen, and they cannot progress very fast; wherefore proper spots are selected for raising the water. Below, in the mine, several perches intervene between them, and there they are also guarded from caving in; they are cut down to those spots in the mine where the water collects, and are called *midzu nuki*, or water-drainings. In all of them the wind circulates. The expense of making them in this manner is exceedingly great; the miners construct them according to their own ideas, and they are indispensable. From thirty to fifty years are occupied in making them."

Plate IV. *Roasting the ore.*—In this plate, the artist has apparently endeavored so to foreshorten his drawing, that the roof shall appear high above the kiln; if such was his intention he has rather failed, for the roof is drawn so near to the fire bursting from the kiln, that it would soon be consumed, were it so built. The kiln appears to be built in a solid and permanent manner, but without the covering of straw mentioned in the text.

"To roast the ore, a kiln must first be built, having vent-holes in it, through which the draft will pass to the fire. Faggots are spread upon the bottom of the kiln, and the ore laid upon them in rows, and thus alternately, faggots and ore, until the kiln is full. A covering of matting, straw, thatch, and other similar things, is then placed over it, and sprinkled with water, and the fire lighted at the mouth. Generally it burns thoroughly in about thirty days, and when cooled is taken out."

Plate V. *Smelting the ore to extract the coarse metal.*—The furnace, in this plate, is represented as sunk in the earth, and the smelter is standing over it with a long shovel in his hand to manage the fire. The bellows, which is separated from the furnace by a wall, is made like the Chinese *fung seäng* or wind-box, of which a description is given in the Repository, vol. iv., page 37.

"The ore being roasted, is put into a furnace, where coal is employed to melt it: the scoria having flowed off, the coarse metal is taken out; it is copper imperfectly purified."

Plate VI. *Taking out the copper when the coarse metal is fused.*—This plate is intended, as supplementary to the last, to exhibit the mode of taking out the copper after a second melting of the coarse metal. The fire having gone down, a workman stands over the furnace with a broom, with which he sprinkles the metal as a second workman takes it out on the end of a hooked pole: a third is represented as having just thrown a mass of metal into a pool of water.

"When the coarse metal is melted in the furnace, and the scoria has flown off, the copper is taken out."

Plate VII. *Of fusing silver and copper together.*—This plate resembles the preceding, but is intended to represent the taking out of metal after a second melting, when the silver is still alloyed with it. In this plate a bellows is drawn on each side of the furnace in lieu of the double-handled single one, in the preceding plate. While one workman is engaged in sprinkling and taking out the copper from the furnace, a second is plunging a large mass into a tub of water. The title of the plate literally means "together blown," and is rather a second purification of the copper ore than alloying it with silver.

"The silver which is mixed up with the copper is melted, and the scoria taken out; it is therefore called *mabuki doü*, or alloyed copper."

Plate VIII. *Casting the bars.*—Here we have a large sinewy man represented pouring the melted metal out of a large crucible into a wooden pool full of water; while another opposite to him holds a pair of pincers to take out the bars. The exhibition of muscular tension in the drawing of the gigantic man who holds the crucible is creditable to the artist.

"The alloyed copper is put into an earthen crucible and fused, and then poured into moulds to form the bars of copper. These bars are sold to foreigners, and are as excellent as if for imperial use. That which natives buy is smelted in the same manner; but the mode of casting, and the moulds, are different; therefore these are in all sorts of shapes;—one is made by pouring the copper into a bamboo stuck in the ground."

Plate IX. *Fusing lead with the copper.*—In this plate, one workman, his face muffled and his legs guarded from the fire of the furnace by a mat, has just taken out a mass of copper, and placed it in a trough; while a second, with a spade-like tool, is assisting him in working it.

"When silver is combined with the copper, lead is added to it, and they are melted together; it is then called *aïbuki doü*, or combined melted copper."

Plate X. *Separating the lead from the copper.*—In the previous plates the form of the furnace has been the same, that of a caldron imbedded in the ground even with the surface of the earth, having the bellows placed on the other side of the intervening wall, and the blast carried into it below its level. No covering is represented, and the flame ascends into a cowel chimney. In this plate the form of the furnace is oblong, with a

curved facing in front; a fender, kept in its place by a rod attached to a post, guards the liquid metal from running out, except at a small orifice, which the workman manages with his spoonlike rod.

"The 'combined melted copper' is put into the furnace and heated almost to liquifying, when the workman, holding an iron tool upon the surface of the copper, restrains it from flowing, but allows the melted lead to run off. The copper is called *shibori doü*, or wrung-out copper, i.e., pure copper. By this process the silver and lead contained in the copper are extracted, whence it is termed 'the wrung-out (or purifying) fusing; the rules for the process were derived from foreign countries, and it is on this account also called 'the fusing of the southern foreigners.'"

Plate XI. *Separating the silver from the lead.*—The furnace in which the cupellation is performed resembles a cupola furnace, rising about three feet, and having the fire somewhat below the surface. The assayer is stooping over the fire, intently watching the metal.

"The lead previously extracted is put into an ash furnace, and slowly melted by a coal fire; the lead sinks to the bottom among the ashes, and the pure silver appears coming out of the centre. It is called *hai-buki gin*, or 'ash-melted silver.'"

Plate XII. *Of rinsing and sifting.*—Here we have two tubs of water, at which are women rinsing the pounded scoria; troughs stand by them for receiving the metallic portions, and a workman is shovelling the heap of scoria.

"Within the earthen crucible, used in melting copper, there is an earthy residuum, which, with the scoria, is put into a stone mortar, pounded fine, and afterwards rinsed. As the water in the bowl flows off, the earthy particles, being light, also run off as useless. The cupreous portion, being heavy, remains in the bowl, whence it is taken."

Plate XIII. *Fusing lead.*—This plate is supplementary to those on copper, introduced probably on account of the frequent mention of lead when speaking of copper. The furnace is represented as distinct from the crucible or caldron in which the lead is melted; the fire is underneath it, and communicates with the bellows below the surface. The fire is pictured as having gone down,—one workman is lading lead into small oblong moulds, while a second is cooling them in a tub of water, and a third cording the bars of lead into small faggots,

"The ore of lead comes from the hills; it is fused in a crucible; and afterwards poured out into copper moulds to form bars of lead."

Succeeding these thirteen plates are as many more, representing the implements used in smelting copper and lead, and specifying their names and uses. To the professed metallurgist, this this would be a very interesting part of the work; but it will be neither entertaining nor profitable to our readers to be detained with a minute description of them. There are one hundred different drawings, representing the iron ladles, rods, forks, skimmers, pincers, &c., with the sieves, brooms, tubs, crucibles, moulds, mortars, weights, &c., employed in the various stages of the smelting. The last page is occupied with diagrams of the bellows.

The remainder of the volume is filled with an account of the process connected with extracting copper from the ore, written in Chinese, and corresponding in the main to the Japanese. It is explanatory of the former, and renders the whole account much more complete than it otherwise would be. It is drawn up in excellent Chinese style, and is a good specimen of the capabilities of that language to describe even the most technical operations. The Japanese writer has added the terminations of the cases, the prepositions and other grammatical marks by which a native of that country is enabled to read Chinese with much more facility and accuracy than he otherwise could do. In the translation, we have introduced the Chinese characters along with the names of places, in order that the means may be afforded for ascertaining their native names by those who have access to educated Japanese. These, in many instances, are so different from the sound of the characters themselves, as to afford no clue whatever to the names of the places designated, if the reader does not happen to know the very characters employed to write that name. Thus, the three great cities in the empire, Yedo, Ohosaka, and Kioto (or Miyako), are severally written *Keăngkoo*, *Taepan*, and *Kingtoo*; the last is a descriptive term, meaning the imperial city; it is where the dairi or kubo resides. This being their mode of using the Chinese character in writing proper names, we have thought it would be best to introduce them; the same remark applies to names of individuals, officers, and indeed every use of the Chinese. A few sentences occurring in the preceding paragraphs will be met with in these; but being embodied in the original, they could not very well be omitted, and the whole is translated as it stands.

Memoir on Smelting Copper.—"The places in this country where the most copper is obtained are Besh-shi in Yo, Nanbu in Aü, and Akita in U; next to these places are Sonsan in U, and Shiöya in Tan; and the poorest are Ginsan and Sheükoku in Sheki, Kitsukaü in Bi, Beïwa in Ki, Kinsan in Sa, Taiya in Yetsu, Taten in So, and some others. From some of these places, there is at times much, and at others little, produced; the mines are sometimes open and sometimes shut. Besides these, there is so large a number which produce but little, that they can hardly be enumerated. Now the productive veins have limits, and the branching offsets cease midway; some of them will not repay the outlay; others, the owners are unwilling to dig; and again there are others which are not worked on account of the labor attending them: of all these there are many. The copper ore sometimes contains both silver and lead, and at others it is pure without any admixture; it is also alloyed with zinc. The rules for smelting are also dissimilar. Th re is some copper which is wrought by hammering, and some which is cast by fusing; generally speaking, that which contains silver and lead is softer, and is hammered into sheets, or drawn out into wire. That which is alloyed with zinc is very solid and hard, easily fractured if hammered, and unsuited either for sheets or wire; but if the soft and hard be fused together, there is no danger of its fracturing. If lead or tin be intimately blended with it, the alloy is very sonorous, well adapted for mirrors and bells. However, each has its own rules; and if [the reader wishes to read] the rules for quarrying, smelting, &c., they are briefly explained in the following pages.

Sec. I. *Of the ore.*—"All copper localities produce ore accompanied with earth and barren rock. When the mine contains copper ore, its evidence will always be found on the top of the hill, of a reddish-black hue, coloring both the earth and stones. It forms a connected vein, either long or short, broad or narrow; either deep or shallow, rich or poor, according as the ore is much or little; for it is the effluence of the copper which steams up and forms it, and the miners diligently examine its aspect, in order to judge whether the copper will be much or little, good or bad.

Sec. II. *Of digging the ore.*—"When the appearances on the top of the hill betoken good ore, [the miners] dig several perches into it in a circuitous manner; as they penetrate, setting up posts and joists, and laying boards and rafters upon them,—stopping the empty interstices with stones and dirt, in order to prevent the pit caving in. The miners carry a lamp made from a shell, as they work the ore and fill their buckets. The number of days or months required to penetrate ten or twenty perches cannot be determined. Sometimes ore will be, and sometimes it will not be, met with; and when it does occur, the lode will suddenly stop, and again be resumed; and at times it will continue on without faults: there are lodes which grow smaller and narrower, the further they are followed; others suddenly contract, and as suddenly enlarge; some diverge, and others are without any branches. The rock which envelopes the ore varies in its aspect. The barren rock is thrown aside as of no further use. The ore is of many sorts, yellow, black, reddish and grey, brilliant and dull; some of it contains much, and some of it little. Indeed, the nature of the mine is not uniform, nor is it possible to obtain the ore alike in order to average the good and bad. When dug out, the ore is broken to fragments, and the process of selection and throwing away the barren stone is called *kaname* (or examining the ore). Generally, the best ore produces one tenth of copper, and the poorest, one twentieth.

Sec. III. *Of roasting the ore.*—"Whenever ore is roasted, a kiln is built under a shed. Faggots are spread upon the bottom and ore laid upon them; a layer of faggots and one of ore alternately are piled up to the brim. A vent-hole is cut in the bottom of the kiln for the draft to be free. The smoke is so sulphureous as to suffocate one, and the fire cannot be approached. When the fire has burned ten days, and gone out, the whole is cooled and taken out, but the ore has undergone but little change. These are the general outlines (of the mode of roasting).

Sec. IV. *Extracting the coarse metal.*—"Whoever extracts the coarse metal, constructs a wall in a building, and [on one side of it] makes a large furnace, having a trough leading out of it; on the other side of the wall two large bellows are placed. The roasted ore is then put into the furnace upon the coal, and two tall men pull the bellows, while a third, holding a long iron rod, stands before the furnace to separate and level the mass. When the fire has reached its strength, and the liquid metal has risen and filled the furnace, the earthy scoria floats upon the surface, and little by little flows off into the trough; as it flows out, it is suffered to cool, or else water is sprinkled upon it, and it is taken out and thrown aside. When the ore is all melted, more is added, and additional coal placed upon it, until the furnace is full of good metal, when the earthy scoria and coals are all pushed off. Water is then sprinkled upon the top of the furnace, to cause the liquid metal to separate from the cold, and form a crust which can be raised up. An iron pole is employed to peel it off and take it away; first sprinkling and peeling, until all is taken off, when there is found at the bottom of the furnace a mass of copper; if, however, the ore is poor, there may be none.

Sec. V. *Of extracting the copper.*—"The rules for calcining the coarse metal, and extracting the copper, are for the most part like those for melting the ore and extracting ths coarse metal. But when the furnace is full of liquid metal, the top is luted with clay, leaving a small hole in it, in which to put the coal and blast the charge. If there is any scum, take it out immediately, and wait till the whole mass is thoroughly fused; then open the furnace, and entirely remove the ignited coal and earthy slag; after which, wait till the heat has abated a little, and then, sprinkling the surface, take it out in the same manner as when taking out the coarse metal.

"All the operations described above, from quarrying the ore out of its bed to the first making it into pure copper, are done at the mine. The officers' orders are that no copper shall be privately sold, but that it must all be carried to the Riau-kwa foundry; where the superintendents direct the founders to smelt and cast it, then assort the various qualities and affix their corresponding prices. That which is delivered at Nagasaki and Kwashi is from Besh-shi, Akita, and Nambu. That which is brought to market for ordinary purposes of manufacture is all produced from other places besides these three. The number of founders is likewise fixed; they cannot be lightly increased or diminished, lest malpractices should arise. That copper which contains silver, and that which contains zinc, and the pure metal, must not be mixed. There are these two operations carried on in the foundry.

Sec. VI. *The second smelting.*—"Every district which produces copper has it smelted a second time in a foundry furnace. When fused, take off the slag and the coals, and then work the bellows a second time until it is liquified; wait till the heat has abated a little, sprinkle water upon it to concrete it, and then take it out with an iron rod. This is re-smelted copper or fine metal. [The mass] is about a cubit broad, and half a cubit thick, being a little smaller than the bottom of the furnace. The process is for the most part like that of extracting the coarse metal. Generally speaking, about 250 catties can be melted in the furnace at once, and there are three fusings in a day.

Sec. VII. *The third smelting.*—"The twice smelted copper is put into an earthern crucible, placed in the furnace and melted. A tub of hot water is set near at hand and a square wooden pool made, into which the moulds are placed; and over them a thick hempen cloth spread. When the copper is melted, the scoria taken off, and the fire reduced, hot water is poured into the pool (not very hot), until it is almost level with the moulds; then the smelter, firmly grasping the crucible with a pair of large iron pincers, pours [the metal] into the moulds, which are previously sprinkled with warm water lest the mould should crack.* Afterwards water is sprinkled upon the bars to cool them, and they are taken out with a pair of iron nippers. Each casting produces ten or more bars; they are seven or eight inches long, and weigh about ten taels (i.e. nearly a pound av.) each. The copper is all poured off in about ten times, and the crucible is fused ten times in a day. In this manner are made the copper bars which are brought to Nagasaki and Kwashi.†

"The above are all the rules for smelting pure copper; there are others for taking the re-smelted copper, fusing and casting it into square, or round, or other shaped moulds, as will be presently explained, and these are, in the main, similar to those for making copper bars.

"Copper was first brought to this country by eastern people. According to the Memoir on Copper, the year was between the reigns of Genki and Tenshei. For about a thousand years, the metal from every district was chiefly of the third quality, as they had not learned how to extract the silver; so that they could be called deficient in manipulation. For this is known from the fact, that if broken copper utensils, made in the reign of Tenshei and before him, be smelted, silver can always be extracted from them. The silver used in those days was all obtained from mines. At the end of Tenshei's reign, certain foreign merchants came to Sakai in the country of Shen, and taught the mode of extracting silver to Sumitomo Zhiyusai; this was in the year 1591. In the reign of Tsungching of the [Chinese] Ming dynasty, from that which was produced at Soü-yoü-shei, the furnaces of Tenkoü and Kaimutsu became skilful in extracting the silver, though the mode of operation was different. Teënching reigned the fortieth year after this, in 1631. From Sumitomo Zhiyusai and after, the family has followed the occupation of mining and smelting copper; the fourth in succession was called Sumitomo Tomoyoō, and he discovered a copper mine in the department of Yo (or Yo shiu), while Genroku reigned, which he desired leave to open; it has yielded not less than 7,000,000 catties of copper annually, while it has been constantly worked up to the present time, more than a hundred years. For seven generations past, this family has superintended the Raükwa foundry; and because the designation of the foreign merchants was Shiromidzu, they have joined the two characters to form Shen, their present mark. He who first in this country extracted silver from copper was undoubtedly Sumitomo Zhiyusai, but people generally did not know this fact, and therefore this explanation has been introduced.

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* "If cold water is indiscreetly sprinkled [upon the moulds], or if the crucible is cracked, in both cases an explosion will take place; and because the lives of persons are endangered by such an accident, great care should be used to guard against it." Note in the original.

† Thunberg says "the copper, after being roasted and smelted at the smelting house, is refined and manufactured at Miyako, where also all the coin is struck." Vol. III, page 141. The foundry of Raukwa, mentioned in this account, may be at Miyako, but we have no means of ascertaining.

Sec. VIII. *Of alloying copper and lead.*—"When silver and zinc are combined with the copper, lead is added and placed on the top of the furnace, and the whole mass fused. When the earthy slag and hot coals are removed, an iron pole is used to take it out by adhesion; its appearance is that of broken tiles, and it is called *awashe kane*, or alloyed copper. Generally there are eight parts of copper and two of lead; but the lead is according to the quantity of silver: if there is much, then more is added; if little, the lead is reduced.

Sec. IX. *Of separating the lead and copper.*—"The alloyed copper is put into a Namman furnace (so called because the southern foreigners introduced it; it is built of earth), and coal added by degrees as the bellows is worked. A crooked iron rod is used to stir the metal about in the clay, but it must not be allowed to become melted so as to run. When the lead is fused, it will flow off, carrying the silver in combination with it. If the zinc is also ready to run off, the workman with his iron rod stops and turns it off, so that it may not mix with the lead; it usually remains just between the lead and copper. When the lead has all run off (*i. e.* that combined with the zinc), then scoop the zinc up and take it out; and when both the lead and zinc are separated, sprinkle water and take out the copper; it is called *shibori doū*, pure (*lit.* wrung out) copper. The lead in the hollow place cools and forms a round mass (called *shiyuts shiyo*, or extracted lead); it still combines silver with it, which does not shew itself. Truly this process of separation must be regarded as very elegant!

Sec. X. *Sinking the lead to extract the silver*—"The first thing in cupellating the silver is to construct an ash-furnace; the foundries of Tenkoü and Kaimutsa call it an ash pool; it is made of sifted ashes, placed on the earth, having a depression about a cubit wide, and a hollow place in its middle. When the lead is in, coal and fire are put on, and a defence formed of wet ashes like a wall or dyke is built around, leaving a hole in front to work the bellows (as well as to see the state of the fire), on the top of which a cover of a broad tile is closely luted with wet ashes. The bellows is then gradually blown until the fire attains its strength, causing the lead to drop into the ashes, where t forms a mass upon the bottom. The lead is called *ruikasu*, and is afterwards purified from the ashes. The silver floats in the middle as a small round cake, and is called *haibuki gin*, or ash-melted silver. Such are the rules for extracting the silver.

Sec. XI. *Supplement of rinsing the scoria of the copper and zinc.*—"The separated copper is of the same quality as the re-smelted; it is melted and made into copper rods, and into ingots for hammers and nippers. That cast into square sheets is used to tile houses, the round is made into cups, the oblong pieces are employed in constructing eave-troughs, and the long rods are for making wire. If the lead and zinc are not completely separated, the copper will split and crack when hammered; it is consequently very important that at the time of smelting it be perfectly purified. Zinc is only used as an alloy in making mirrors and warming stoves and bells; if it is combined in the copper, that metal will not stick to the moulds; but, when taken out, the engravings and ornaments will be distinct and clean.

Sec. XII. *Of the washing and rinsing.*—"The fragments of copper taken from the refining furnace which adhere to the scoria, and that from the crucible, are beaten in a mortar, sifted and then rinsed in water, in order to obtain the copper.

"Written by Mas'tadzuna (or Soü ten-boü) a pupil of Sumitomo Zhiyusai in Raükwa."

When Thumberg accompanied the Dutch embassy to Yédo in 1776, the party after much entreaty were allowed to see the operation of casting the copper bars at Ohosaka, which he thus describes. We introduce it as the testimony of an eye-witness to corroborate the native account.

"The operation of smelting of copper was one day performed particularly for us, and merely on purpose that we might see it, in consequence of the importunate intreaties both of our chief and our conductors. This was done with much greater simplicity than I had imagined. The smelting hut was from twenty to twenty-four feet wide, and a wall like a niche was built up, with a chimney on one side of it. At the bottom of this, and level with the floor, was a hearth, in which the ore, by the assistance of a hand-bellows, had been smelted before our arrival. Directly opposite, on the ground, which was not floored, was dug a hole of an oblong form, and about twelve inches deep. Across this were laid ten square iron bars, barely the breadth of a finger asunder, and all of them with one of their edges upwards. Over these was expanded a piece of sail-cloth, which was pressed down between the bars. Upon this was afterwards poured cold water, which stood about two inches above the cloth. The smelted ore was then taken up out of the hearth, with iron ladles, and poured into the above-described mould, so that ten or eleven bars, six inches long, were cast each time. As soon as these were taken out, the fusion was continued, and the water now and then changed. That the copper was thus cast in water, was not known before in Europe, nor that the Japanese copper hence acquires its high color and splendor. At the same time I had the good fortune to receive, through the influence of my friends the interpreters, a present of a box, in which was packed up, not only pure copper cast in the above-mentioned manner, but also specimens taken from every process that it had gone through, such as the crude pyrites with its matrix, the produce of the roasting, and of the first and second smelting. * * * *

"After this we saw a quantity of cast copper, not only in the above-mentioned form of bars, as it is sold to the Dutch and Chinese, but also cast in larger and smaller, round and square, thicker and thinner, pieces, for other purposes, according as they may be wanted for the fabrication of kettles, pans, and other utensils."

The copper exported by the Dutch is, according to Thunberg, packed in long wooden boxes, each containing one pecul. A cargo consists of six or seven thousand chests. The bars, he says, "are six inches long, and a finger thick, flat on one side, and convex on the other, and of a fine bright color. Each bar weighs about one-third of a pound." One of the bars now lies before us. It is nine inches long, flat on one side and convex on the other; the upper side much blistered, of a dark carmine color, and weighs 11 taels, 3 mace, and 8 candareens, or 15·12 oz. avoirdupois.

TRANSACTIONS OF THE SOCIETY OF ARTS.

November 7th, 1849.

(Being the First Meeting of the Session.)

The following address from the Council was read by the Secretary:—

The Council congratulate the members assembled upon the commencement of the 96th year of the Society's proceedings.

They congratulate the Society upon their increasing means of usefulness, and the cordiality with which their exertions for the public good are met on all sides. Their ordinary revenue has increased, in seven years, from £800 to £1600; the whole of which is directly expended in the promotion of arts, manufactures, and commerce. It is a remarkable feature in the present state of the Society, that it now expends no more money upon its establishment of officers and servants than it did in 1841, when its condition was the reverse of prosperous. The present list of fifty-eight candidates for election as members may be appealed to as an event altogether without precedent in the history of this Society, and attests its growing power and usefulness.

The Council have, during the session, issued a prize-list for 1850, in its various departments of agriculture, arts, mechanics, and manufactures; in which, it will be observed, that upwards of £600 worth of premiums and medals are offered for competition. They are happy to add, that, at the head of the list, stand the two gold medals of H.R.H. the President. The Society has to be congratulated on the admirable exhibition of paintings which clothed the walls of the great room during the summer. It was visited by thousands of persons, who then saw, for the first time, these great historical paintings. We believe that, until that exhibition, Mr. Etty's transcendent merits were only fully appreciated by the limited circle who had hitherto been fortunate enough to see his greatest works. The Council think it right to express once more their sense of the liberality and enlightened zeal for the promotion of art with which Sir William Allen, the President of the Academy of Painters of Scotland, and the members of the Council allowed their great works to be exhibited here for the first time; and to all the possessors of these paintings public thanks are due for their liberality and readiness in sending them for exhibition. It is a matter of pride to this Society that they have already been the means of making better known to the public the character and genius of two living painters so distinguished as Mr. Mulready and Mr. Etty.

The Council feel it their duty to allude, however briefly, to a great undertaking, which, originating with his Royal Highness Prince Albert, has long been an object of deep interest and gradual preparation, and to which allusion was made in this room at the last general meeting. The members recollect that it was stated, on that occasion, that the great object of a National Exhibition of Industry was more likely than it had ever before appeared to be carried out to a successful issue. This anticipation is now in a fair way to be realized. But, as the Council have the intention of summoning a special general meeting for the purpose of laying before the Society the past history and present position of that great undertaking, they will not further go into the subject, because it is one of too great importance to be treated in a cursory manner.

But, as an appropriate preliminary to such a statement, the Council have thought it well to place before the members the Report of Mr. Digby Wyatt on the great French Exposition of last summer. The Council thought it wise that the Society, having entertained from time to time this national subject, should put itself in possession of what other countries had done towards such an undertaking, although nothing at all approaching to the grandeur of the design and the extent of the exhibition had hitherto been undertaken in any country.

In Mr. Digby Wyatt the Council found a gentleman possessing the requisite professional talent and the taste and judgment required to carry out this view with the greatest benefit to the public. You will find, when you hear the Report, that he has done it also in a manner most creditable to himself.

Mr. Digby Wyatt's Report on the 11th French Exposition of the Products of Industry.

Extracts from this document (which is about to be printed for public use) were read, and verbal explanations given by the author.

The Report—after alluding to the attention paid by the French

Government to the development of the manufactures of that country by precept, example, premiums, public exhibitions, elementary schools, societies of encouragement, &c.; to the traditional excellence of early French productions; and to the modern restoration of that supereminence, by the means before mentioned, now persevered in, with few interruptions, for fifty years,—was divided into three parts.

The first embraced the details of construction, cost, and arrangement of the building, which may be thus briefly described:—It was situated on the Carré de Marigny, abutting on the Champs Elysées;—thus, as a site, offering every possible advantage. The whole plot covers a vast parallelogram of 675 feet by 328, (being about 5 acres), round the outline of which runs a gallery 90 feet wide, divided into two avenues by a double row of pilasters. In the centre of each avenue is a set of stalls for the exhibition of merchandise; and both between the pilasters and round upon the walls other objects are placed; so that in traversing either of the four gangways, the public have on both hands objects for inspection. The parallelogram, thus enclosed, is divided by two transverse galleries, similarly arranged to that already described, forming three court-yards,—the central being 140 feet square, and the two lateral 80 feet by 140.

The central court-yard is open, and in the middle is an elegant fountain. Around are sheds for the exhibition of flowers and horticultural ornaments and implements. One of the lateral courts (enclosed) contains the objects in metal, cast-iron, &c.; and the other contains an immense reservoir, in which all the drainage from the roofs is collected, so as to form a supply of water immediately serviceable in case of fire. In addition, is constructed a vast shed, of a length rather greater than the width of the great parallelogram, and about 100 feet wide, for the exhibition of agricultural produce. A long narrow gallery intervenes between it and the main building. The whole of the building is constructed of wood, and the roofs are covered with zinc, of which nearly 4000 tons have been used, and nearly 45,000 pieces of timber. Carton piërre trusses apparently support the timbers; and a painted bas-relief fills the tympanum of the pediment at the principal entrance. The architecture of the whole is *mesquin*.

Mr. Wyatt stated that the Exposition—

Of the years	Contained an area of square yards as under.	Cost of the building was	The expenses of transporting the goods to and from Paris.	The cost of rewards.	The total cost of the Exhibition.
1839	13,583	£14,551 12*s*.	£4,847 0*s*.	£2,429 12*s*.	£21,828 8*s*.
1844	23,310	14,056 14	5,641 16	3,238 0	23,937 4
1849	27,214	16,000 0	Not yet made up.	Not yet made up.	

To this amount for the present year must be added £2000, the cost of the agricultural shed, making the whole sum expended £18,000. It must be remembered that this money is paid only for the hire of the materials for about three months;—the whole remaining the property of the contractor at the termination of the exhibition.

After touching briefly on the classification of products in former years, Mr. Wyatt proceeded to give that adopted by the jury in 1844. They divided the manufacturing arts into—

1. Woven
2. Mineral
3. Mechanical
4. Mathematical
5. Chemical
6. Fine
7. Ceramic
8. Miscellaneous

Arts on the accidental or natural system.

In 1849, no systematic classification appears to have been adopted,—convenience of arrangement rather than the nature of the product being considered. The great uncertainty of the uniform supply of goods from year to year renders it extremely difficult to complete any preliminary arrangement. Thus, machinery, which in 1839 was comparatively a minor item, is in 1849 a great and predominating attraction. The products of Mulhausen (cotton and mixed goods), which in 1839 required a large hall for themselves, sunk this year into the ordinary space required by other branches. It is in articles of taste, however, that French workmen exhibit their greatest strength. We scarcely ever see a piece of bad ornamental modelling. The human figure is rarely ill drawn, and we recognise everywhere a practised hand and a thoughtful head. With a few exceptions, the French are before us in every ornamental art; and in machinery also they have this year displayed their power in mechanical resources to an extent that would be alarming, if we were not ourselves in a state of continual progress. Mr. Wyatt also alludes to the excellent liberality of the French Government in the whole expenditure; and to the perfect arrangements for free ingress and egress, and for unanimous movement. The catalogue contained a double series; and the exhibitors were allowed, with great advantage, to fit up their own stalls. The goods, however, on the whole, wanted arrangement, and the building had the defect of containing no one grand hall; whereas on the occasion of distributing prizes a great assemblage might take place. Mr. Wyatt believes that a better building might be erected in England at a much less cost, probably by one-fourth.

The second part of the report contains a history of all the past expositions, from the original idea of the Marquis d'Avèze, in the year 1797, down to the present time; and a table is given shewing the general conditions of many of them.

The third explains the official arrangements by which the Minister of Agriculture and Commerce is required to carry out each exposition. The institution of a central jury for awarding the prizes is said to have worked well;—that jury consisting of retired merchants and manufacturers, professors, engineers, and men of science, of a reputation and standing sufficiently high to place their verdict above all question.

The appendices consist of various papers, by means of which the formulæ of correspondence, &c., are conducted; and No. 4 contains the decree by which the last Exposition was announced to the public.

Nov. 14*th.—The subject before the Meeting was a paper by* MR. H. H. RUSSELL, *on his mode of constructing Suspension Bridges and Landing Piers.*

The paper commences with some preliminary remarks on the origin and adoption of suspension-bridges, which would appear to be of great antiquity, Humboldt and other travellers having seen them in uncivilised countries constructed of bark, reeds, bamboo-cane, &c., slung across wide and dangerous chasms, and used for passenger-traffic. In Thibet and China they have been found sufficiently strong to enable beasts of burden, and men with loads and palanquins, to pass over in safety. The application of this mode of constructing bridges in our country was first made by Captain Samuel Brown, R.N., in what he termed his "Chain Cable Bridges," and was first suggested to him by the rope bridge of Penipe. Bridges of this description were constructed, and others proposed, by Telford, Mr. Tierney Clerk, and others. The success of these bridges gave so great a stimulus as to cause their introduction into almost every civilised country in Europe; and their partial destruction has led to various arrangements for increasing their stability, especially with a view of arresting the undulations which may be excited in them. The principle adopted by Mr. Russell was first suggested to him by witnessing the rigidity of two lines of cobwebs crossing a street in the direction of the main-chains of the bridge; a third, running in a nearly horizontal direction underneath, was supported at intervals from the upper two in the one spandril, and in the other had a circular web, of large dimensions, also stayed in all directions to the upper and lower webs; and a large spider was observed to cross the lower cord without causing sensible deflection. Mr. Russell's improvement in the construction of suspension bridges consists solely in a novel method of applying the main chains thereof from which the platform or roadway is suspended; for, instead of each chain being connected at its ends to the upper part of two piers or towers (which is the usual mode of applying the main chains), each chain is secured at one end to the upper part of one tower, and at the other end to the lower part of the other tower; so that the chains from two adjacent towers cross each other at a point midway between the towers; whereas, in the ordinary plan, the chains lie parallel to each other, or nearly so. By this arrangement the structure will, it is conceived, be more rigid, and the disturbance to which the bridge is subject less felt.

The disturbances to which chain bridges are subject are of two kinds—undulatory and oscillatory. The proposed plan prevents, it is conceived, the undulation, by relieving the summit of the piers from a great part of all strain, and throwing it upon their lower parts, where it is resisted by the roadway in the direction of the greatest strength. The oscillatory disturbances, or those from side to side, are considered to be practically annihilated by reason of the smaller curvature of the chains; and the more equal distribution of the load renders any local pressure less effective in causing disturbance; and additional facility is afforded for the introduction of stays between the chains, so as to equalise to a greater extent the tension and strength of the parts. The attachment of chains to the upper and lower points of the piers diminish, it is conceived, the tendency to general oscillation, while the alternation of long and short suspension-rods, and the steadying of the longer rods by passing between links of the lower chains, must almost entirely obviate local oscillation.

Mr. Russell is of opinion, that, by the mode suggested, a counter action to any passing weight is obtained by the lower portion of the catenary curve being supported on the pier through which it passes. The masonry above, supporting the upper chain, acts so as to prevent deflection of the upper chain, unless the lower chain or pier should ascend, which is impossible, for the weight upon the suspension-rods is applied to both piers, thereby affording rigidity against action upwards.

Nov. 21st.—The Secretary read the following Letter relative to the death of Mr. W. Etty, R.A.

8, Adam-st., Adelphi, London, 21st Nov., 1849.

DEAR SIR,—I doubt not but that most of the members of our Society will ere this have heard of the death of Mr. Etty, which took place at York on the 13th inst., in the 63d year of his age. An incautious friend advised him to leave off wearing flannel,—the throwing aside of which, in his delicate and long precarious state of health, added to, and brought on, an accumulation of disease, against which his already weakened frame gave way.

It must ever be a most gratifying feature in the history of the Society of Arts, to all who took an interest in the exhibition of his works and in the Fine Arts of this country, that the paintings of one of its brightest ornaments were selected *this* year. It being a regulation of the Society that only the works of *living* painters are to be exhibited, it would have now been too late; thus we should have lost one of the best opportunities of shewing to the world the successful labours of a long life devoted to his art, and at his death encircled with a halo of glory the closing scenes of a luminary which has now set for ever.

I could not refrain from calling the attention of the meeting this evening more particularly to the subject, as it seems to me an opportunity for shewing some little testimony of respect to the memory of one whose works so recently adorned the walls within which you are now assembled. To-morrow morning his remains will be conveyed to their final resting-place. His fellow-citizens are about to honor him with a public funeral, attended by the Mayor and Corporation of York, and everything outwardly to demonstrate their high estimation of his character and talent. With best respects, I am, dear Sir, faithfully yours,

J. Scott Russell, Esq. CHAS. W. WASS.

A short notice of the life of the late Mr. Etty, R.A., taken from the Observer *of the 19th inst., accompanied the Letter, and the following Postscript was added by the Secretary:—*

After the exhibition of his works at the Society, he immediately left London on a visit to Oxford; but, contrary to his original intention, he retained possession of his chambers in the Adelphi, with a view, as he stated, to having a home in London, where he might, for the few remaining years of his life, meet his brother artists during the season. At the end of one month he left Oxford, to take up his residence at his house in Coney Street, York; a house which he had, when a poor boy, looked up to as a home far beyond anything he could aspire to, and the possessor of which he had thought of as the great man of the city; but which house he had lately purchased. Here he expressed to his friends a hope that he might spend the remainder of his days quietly; not, however, in idleness, for he had long lent, and still intended to have continued his assistance to the School of Design at York.

After a residence of only a few weeks in his native place, he was taken ill; and, owing to an internal disorder and a combination of diseases, he expired after a short illness.

A supplementary paper on Mr. H. H. Russell's mode of constructing Suspension Bridges was read.

The Assistant-Secretary read a paper on Flexible Breakwaters and Lighthouses, by Mr. W. H. Smith, C. E.

The paper, after alluding to the lives and amount of property annually sacrificed on our coasts—a loss which falls not on the shipowner or the underwriter, but upon the community at large—referred to various efforts that have been made by means of floating breakwaters to effect an economical barrier to the sea. These structures were subject to the following objections:—1. The danger of the isolated sections fouling each other. 2. Being adapted alone to shallow water. 3. Tendency to sink, from saturation of timbers, weight of chains, &c. 4. Want of access from one to another, or to the shore. 5. Their having no effect on the ground-swell. 6. Taut mooring.

The peculiar principle of Mr. Smith's proposed breakwater is to give elasticity to the structure. The breakwater is to consist of a long wall of open framework, divided into separate sections of about fifty feet broad, each secured and pivoted at the bottom on screw-piles, in such manner as to admit of the section swaying to and fro when acted on by the waves. Braces, with counterbalance weights in the centre thereof, are attached to the upper part of each division, and their outer ends are secured at a suitable distance on each side of the breakwater by the screw-pile or any other holdfast. The sections, on being struck by the sea, yield to it, thereby eluding its violence; and the wave, passing through the close grating or framework, becomes disseminated. The structure recoils when it becomes in equilibrium with the wave; and on its return still further cuts it up. Excepting when under the influence of a storm, the breakwater is comparatively motionless. The author conceives it to be applicable to every situation for the formation of harbours. The material employed may be wood or metal; and, in answer to a question on the subject, Mr. Smith stated that the cost of the breakwater, if made of wrought-iron, would only be one-twentieth of the cost of a stone breakwater; and if of wood, it would only be one-fiftieth the expense. The same principle of giving elasticity to the structure is proposed to be applied to lighthouses, whatever the variation of circumstance, either as regards depth of water, situation, and peculiarity of bottom, from the hardest rock to the loosest quicksand;—the object proposed being to attain the greatest possible strength and the least possible shock from the force of the sea or wind-draft.

A model of a lighthouse, constructed on this principle, was also exhibited. The small room or building, on which the lantern is erected, is secured to the upper part of a circular frame of beams or rods, which are arranged so as to form a kind of hollow mast, about two feet in diameter, and this is secured at the bottom to screw-piles. From the upper part of this mast, a series of jointed braces or stays, about three inches thick, extend in all directions around it, and are secured at their outer ends by piles or mushroom anchors. To these braces counterbalance weights are not fixed, as was the case with the braces of the breakwater; but, in place thereof, a large counterbalance weight, in the interior of the mast, is connected by chains with the whole of the braces. The object of applying the counterbalance weights in either case is to produce the recoil of the structure after it has yielded to the shock of the wave.

LIST OF REGISTRATIONS EFFECTED UNDER THE ACT FOR PROTECTING NEW AND ORIGINAL DESIGNS FOR ARTICLES OF UTILITY.

1849.

Oct. 27. *William Cook*, of Regent-street, London, for the "hydraulic gas-stove."

27. *Arthur Hills*, of The Chemical Works, Woodside, Croydon, for a metallic carboy-basket.

Nov. 3. *Benjamin Richards*, of Dudley Port Foundry, Tipton, for metallic moulds for casting weights and cable-chain studs and stays.

3. *Weiss & Son*, of 62, Strand, London, surgical instrument makers, for the "invalid's reclining bed-couch."

Nov. 6. ***William Rye***, of Oldham, machine-maker, for a "taking up" roller for power-looms.

6. ***Thomas Tozer***, of 55, Dean-street, Soho, London, furnishing ironmonger, for "the Calorifere."

8. ***William Ford***, of 10, Holles-street, Cavendish-square, for the "lady's winter polka jacket."

8. ***William Blenkiron***, of 123, Wood-street, Cheapside, for a fastening of shirt collar.

10. ***Gabriel Davis***, of Boar-lane, Leeds, optician, for a mercurial steam and hydraulic pressure gauge.

12. ***Edward Golding***, of Hurstbourne Priors, Andover-road, Hants., manufacturer of bone manure, for the "rolling barley chumper."

14. ***Robert William Jearrad***, of 260, Oxford-street, London, for washing apparatus.

16. ***William Leschallas***, of 32, Budge-row, for a metallic lock envelope.

17. ***Lütge & Co.***, of King Edward-street, London, for a form of attachment or connection between the linings and fur portions of lined fur articles.

17. ***Thomas Frederick Hale***, of 3, Narrow Wine-street, Bristol, brass founder, for an improved plunge cock.

19. ***William Macbay***, of Woolwich, Quartermaster Sergeant, Royal Artillery, for the "mercantile fountain pen."

20. ***William Naylor***, of 56, James-street, Oxford-street, for a glass ventilator for window-sashes.

21. ***Charles Macintosh & Co.***, of Manchester, for a buckle.

21. ***John Elce & Co.***, of the Phœnix Iron Works, Manchester, for a dynamometer.

21. ***Thomas Kitson Potter***, of Huddersfield, for the "Victoria spirit lamp."

21. ***Samuel Butler & Co.***, of Birmingham, for a revolving heel for boots, shoes, and clogs.

22. ***Reynolds & Tillcock***, of 102, New Bond-street, for the "ladies' haut ton vesture."

23. ***Thomas Melling***, of Rainhill Iron Works, near Liverpool, in the county of Lancaster, engineer, for a game register.

23. ***Lewis Le Richeux***, of High-street, Homerton, stock-maker, for a spring for a spring neckcloth.

23. ***Gilbert Dickenson***, of 114, New Bond-street, lithographer and publisher, for the "comprehensive drawing folio."

23. ***J. & J. Holmes***, of Regent-street, shawl manufacturers, for the "manifold cloak."

24. ***Francis Birkin Newton***, of 3, Tib-street, Manchester, for the "Newton coat, without seam."

27. ***William Burgess***, of Blackfriars-road and Kingsmill-grove, Key, Newgate-street, for the "gutta-percha hose joint."

List of Patents

That have passed the Great Seal of IRELAND, from the 17th October to the 22nd November, 1849, *inclusive.*

To Thomas Beale Browne, of Hampen, in the county of Gloucester, Gent,, for certain improvements in looms, and in the manufacture of woven and twisted fabrics,—being a communication from abroad.—Sealed 22nd October.

John Goodier, of Mode Wheel, Manchester, in the county of Lancaster, miller, for certain improvements in mills for grinding wheat and other grain.—Sealed 22nd October.

William Edward Newton, of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, civil engineer, for certain improvements in steam-boilers,—being a communication from abroad.—Sealed 6th November.

Pierre Armand le Comte de Fontainemoreau, of No. 4, South-street, Finsbury, for certain improvements in weaving,—being a communication from abroad.—Sealed 22nd November.

List of Patents

Granted for SCOTLAND, subsequent to October 22nd, 1849.

To Alexander Parkes, of Harborne, Staffordshire, chemist, for improvements in the deposition and manufacture of certain metals and alloys of metals; and improved modes of treating and working certain metals and alloys of metals; and in the application of the same to various useful purposes.—Sealed 24th October.

William Finzel, of Bristol, sugar refiner, for improvements in the processes and machinery employed in, and applicable to, the manufacture of sugar.—Sealed 24th October.

William Edward Newton, of the Office for Patents, 66, Chancery-lane, London, civil engineer, for improvements in machinery for planing, tongueing, and grooving boards or planks,—being a communication.—Sealed 24th October.

David Owen Edwards, of Sydney-place, Brompton, London, surgeon, for improvements in the application of gas, for producing and radiating heat.—Sealed 26th October.

John Mercer, of Oakenshaw, in the county of Lancaster, and William Blythe, of Holland Bank, Oswaldtwistle, in the same county, manufacturing chemist, for improvements in certain materials to be used in the processes of dyeing and printing.—Sealed 31st October.

William Henry Ritchie, of Brixton, for improvements in fire-arms,—being a communication.—Sealed 31st October.

Charles Cowper, of Southampton-buildings, Chancery-lane, London, agent, for certain improvements in the manufacture of sugar,—being a communication.—Sealed 2nd November.

Joseph Lowe, of Salford, surveyor, for certain improvements in grates or grids, applicable to sewers, drains, and other similar purposes.—Sealed 2nd November.

John Holt, of Todmorden, in the county of Lancaster, manager of the Waterside Works, for improvements in machinery or apparatus for preparing cotton and other fibrous substances,—parts of which improvements are applicable to machinery used in weighing.—Sealed 5th November.

William Buckwell, of the Artificial Granite Works, Battersea, London, civil engineer, for improvements in compressing or solidifying fuel.—Sealed 5th November.

Thomas John Knowleys, of Heysham Tower, near Lancaster, for improvements in the application and combination of mineral and vegetable products; also in obtaining products from mineral and vegetable substances, and in the generation and application of heat.—Sealed 5th November.

Henry Crosley, of the Firm of Henry Crosley, Son, and Galsworthy, of Emerson-street, London, engineers and coppersmiths, for certain improved modes or methods of, and apparatus for, heating and lighting; for drying substances, and for employing air, in a warm and cold state, for manufacturing purposes.—Sealed 7th November.

Henry Knight, of Birmingham, for certain improvements in apparatus for printing, embossing, pressing, and perforating.—Sealed 12th November.

Adam Yule, of Dundee, master mariner, and John Chanter, of Lloyds, London, for improvements in the preparation of materials for coating ships and other vessels.—Sealed 14th November.

Alexander Mc Dougall, of Longsight, in the county of Lancaster, chemist, for improvements in recovering useful products from the water used for washing, and in treating wool, woollen, and cotton fabrics, and other substances.—Sealed 14th November.

John Parkinson, of Bury, brassfounder, for improvements in machinery or apparatus for measuring and registering the flow of liquids.—Sealed 14th November.

Peter William Barlow, of Blackheath, London, civil engineer, for improvements in parts of the permanent ways of railways.—Sealed 14th November.

George Edmund Donisthorpe and John Whitehead, of Leeds, manufacturers, for improvements in preparing, combing, and heckling fibrous matters.—Sealed 16th November.

Walter Crum, of Thornliebank, Renfrewshire, for certain improvements in the finishing of woven fabrics.—Sealed 16th November.

Alfred Barlow, of Friday-street, London, warehouseman, for certain improvements in weaving.—Sealed 19th November.

Charles Edwards Amos, of the Grove, Southwark, London, engineer, and Moses Clark, of St. Mary Cray, in the county of Kent, engineer, for improvements in the manufacture of paper, and in the apparatus and machinery used therein,—part of which apparatus or machinery is applicable for regulating the pressure of fluids for various purposes.—Sealed 21st November.

Joshua Proctor Westhead, of Manchester, manufacturer, for improvements in the manufacture of fur into fabrics,—being a communication.—Sealed 21st November.

New Patents

SEALED IN ENGLAND.

1849.

To John Cowley, of Walsall, in the county of Stafford, manufacturer, and John Hickman, of the parish of Aston, in the county of Warwick, clerk, for improvements in the manufacture of bedsteads, chairs, tables, couches, and tubular or hollow articles. Sealed 2nd November—6 months for inrolment.

George Park Macindoe, of Mountblow, in Scotland, for certain improvements in machinery or apparatus applicable to the preparation, spinning, and doubling or twisting of cotton, wool, silk, flax, and other fibrous substances. Sealed 2nd November—6 months for inrolment.

Adam Cottam, of the firm of John Elce and Co., of Manchester, machine-makers, for improvements in machinery to be used in preparing and spinning cotton and other fibrous substances,—being a communication. Sealed 2nd November—6 months for inrolment.

John Jordan, of Liverpool, engineer, for certain improvements in the construction of ships and other vessels navigating on water. Sealed 2nd November—6 months for inrolment.

Frederick Octavius Palmer, of Great Sutton-street, in the county of Middlesex, Gent., for certain improvements in the manufacture of candles; and also in the machinery for the manufacture of such matters. Sealed 2nd November—6 months for inrolment.

Lucien Vidie, of Paris, in France, but now of South-street, Finsbury, French Advocate, for certain improvements in conveyances on land and water. Sealed 2nd November—6 months for inrolment.

Charles Cowper, of Southampton-buildings, Chancery-lane, for improvements in the treatment of coal, and in separating coal and other substances from foreign matters; and in the manufacture of artificial fuel and coke; and in the distillation and treatment of tar and other products from coal; together with improvements in the machinery and apparatus employed for the said purposes,—being a communication. Sealed 2nd November—6 months for inrolment.

Michael John Haines, of Lucas-street, Commercial-road, East, in the county of Middlesex, leather pipe maker, for improvements in the manufacture of bands for driving machinery; in hose or pipes; and buffers for railway purposes. Sealed 2nd November—6 months for inrolment.

William Buckwell, of the Artificial Granite Works, Battersea, in the county of Surrey, civil engineer, and Joseph Apsey, of Blackfriars, in the same county, engineer, for improvements in steam-engines, and in propelling vessels. Sealed 2nd November—6 months for inrolment.

Hiram Tucker, of Roxbury, in the State of Massachusetts, of the United States of America, for a certain new or improved manufacture of mantel-pieces. Sealed 2nd November—6 months for inrolment.

William Morris, of Cold-bath-square, in the county of Middlesex, civil engineer, for improvements in the preparing of clay; and in the manufacture of bricks, tiles, and other articles made of clay or brick earth. Sealed 2nd November—6 months for inrolment.

James Combe, of Belfast, in the Kingdom of Ireland, engineer and machinist, for improvements in machinery for hackling flax and hemp; and in machinery for producing flax yarns. Sealed 2nd November—6 months for inrolment.

Alfred Barlow, of Friday-street, in the City of London, warehouseman, for certain improvements in weaving. Sealed 2nd November—6 months for inrolment.

William Edward Newton, of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, civil engineer, for improvements in machinery for dressing, shaping, cutting, and drilling or boring rocks or stone; part of which improvements are, with certain modifications, applicable to machinery or apparatus for driving piles,—being a communication. Sealed 6th November—6 months for inrolment.

James Buck Wilson, of Saint Helens, in the county of Lancaster, rope-maker, for certain improvements in wire ropes. Sealed 8th November—6 months for inrolment.

Charles Edwards Amos, of the Grove, Southwark, in the county of Surrey, engineer, and Moses Clark, of Saint Mary Cray, in the county of Kent, engineer, for improvements in the manufacture of paper, and in the apparatus and machinery used therein; part of which apparatus or machinery is applicable for regulating the pressure of fluids for various purposes. Sealed 10th November—6 months for inrolment.

Charles Matthew Barker, of Lower Kennington-lane, Surrey, engineer, for improvements in sawing or cutting wood and metals. Sealed 10th November—6 months for inrolment.

Richard Ford Sturges and Jonathan Harlow, both of Birmingham, for improvements in bedsteads. Sealed 10th November —6 months for inrolment.

Enoch Chambers, of Birmingham, smith, for improvements in the manufacture of wheels. Sealed 10th November—6 months for inrolment.

Thomas Keely, of the town and county of Nottingham, manufacturer, and William Wilkinson, of the same place, frame-work knitter, for certain improvements in looped or elastic fabrics, and in articles made therefrom; also certain machinery for producing the said improvements, which is applicable, in whole or in part, to the manufacture of looped fabrics generally. Sealed 10th November—6 months for inrolment.

Samuel Brown Oliver, of Woodford, in the county of Essex, Gent., for certain improvements in dyeing and dyeing materials,—being a communication. Sealed 10th November—6 months for inrolment.

Henry Henson Henson, of Hampstead, in the county of Middlesex, Gent., for certain improvements in railways and in railway carriages. Sealed 10th November—6 months for inrolment.* (Dated 14th June, 1849.)

Rowland Brotherhood, of Chippenham, in the county of Wilts, railway contractor, for an apparatus or mode for covering trucks and waggons on railways, road waggons, and canal boats, so as effectually to protect goods in the course of public transit from theft or damage, and at the same time to allow of such trucks and waggons being loaded and unloaded with equal facility. Sealed 10th November—6 months for inrolment. (Dated 18th July, 1849.)

Robert Parnall, of the City of London, clothier, for a new instrument for facilitating the stitching or sewing of woven fabrics. Sealed 13th November—6 months for inrolment.

James Chesterman, of the firm of Messrs. Cutts & Co., of Sheffield, machinists, for improvements in carpenters' braces and other tools and instruments used for drilling and boring purposes. Sealed 13th November—6 months for inrolment.

Charles Cowper, of Southampton-buildings, Chancery-lane, for improvements in the manufacture of sugar,—being a communication. Sealed 14th November—6 months for inrolment.

Louis Adolphe Duperrey, of 112, Faubourg du Temple, of Paris, engineer, for certain improvements in machinery for producing figures in relievo. Sealed 17th November—6 months for inrolment.

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* This and the following patent, being opposed by caveat at the Great Seal, were not sealed till 10th November, but bear date the days they would have been sealed if not opposed, by order of the Lord Chancellor.

Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, mechanical draughtsman, for improvements in manufacturing leather,—being a communication. Sealed 17th November—6 months for inrolment.

Charles Ludovic Augustus Meinig, of Hamburgh, now residing in the City of London, merchant, for certain improved modes or methods of applying galvanism and magnetism to curative and sanatory purposes,—being a communication. Sealed 17th November—6 months for inrolment.

Charles James Pownall, of Kensington, Esq., for a certain mode or method, or certain modes or methods, of ascertaining or registering the number of persons entering in or upon passenger conveyances and passage-ways, and the instruments and apparatus for effecting the same. Sealed 17th November—6 months for inrolment

George Edmond Donisthorpe, of Leeds, manufacturer, and James Milnes, of Bradford, both in the county of York, for improvements in apparatus used for stopping steam-engines and other first movers. Sealed 17th November—6 months for inrolment.

William Brindley, of Nelson-terrace, Twickenham, papier-maché manufacturer, for improvements in producing ornamental designs on papier-maché, and in preserving vegetable matters. Sealed 17th November—6 months for inrolment.

William Buckwell, of the Artificial Granite Works, Battersea, in the county of Surrey, engineer, for improvements in manufacturing pipes and other structures, artificially, in moulds, when using stone and other matters. Sealed 17th November—6 months for inrolment.

Samuel Stocker, of High Holborn, in the county of Middlesex, hydraulic engineer, for improvements in the beer-engines, beer-measures, and tobacco-boxes used by publicans. Sealed 17th November—6 months for inrolment.

Thomas Worsdell, of Birmingham, manufacturer, for certain improvements in the manufacture of envelopes and cases, and in the tools and machinery used therein. Sealed 17th November—6 months for inrolment.

John Webster Hancock, of Melbourne, in the county of Derby, manufacturer, for improvements in the manufacture of hosiery goods, or articles composed of knitted fabrics. Sealed 17th November—6 months for inrolment.

Charles Edouard François Constant Prospere de Changy, of Brussels, now residing in Tavistock-street, in the City of Westminster, civil engineer, for improvements in the preparation and manufacture of flax, hemp, and other like fibrous substances. Sealed 20th November—6 months for inrolment.

Charles Cowper, of Southampton-buildings, Chancery-lane, for certain improvements in the manufacture of sugar,—being a communication. Sealed 20th November—6 months for inrolment.

François Justin Duburguet, of Cahors, in the Republic of France, for certain improvements in hydropneumatic engines. Sealed 22nd November—6 months for inrolment.

Joseph Pierre Gillard, of Paris, in the Republic of France, Gent., for certain improvements in the production of heat and light in general. Sealed 22nd November—6 months for inrolment.

William Garnett Taylor, of Burton House Hall, in the county of Westmoreland, Gent., for improvements in lint and in linting machines. Sealed 24th November—6 months for inrolment.

George Callaway, of Putney, in the county of Surrey, station agent, and Robert Alleé Purkis, of the same place, engineer, for certain improvements in propelling ships and other vessels; also in apparatus for ploughing land. Sealed 24th November —6 months for inrolment.

Charles Cowper, of Southampton-buildings, Chancery-lane, for certain improvements in piling faggoting and forging iron for plates, bars, shafts, axles, tyres, cannons, anchors, and other similar purposes,—being a communication. Sealed 24th November—6 months for inrolment.

Joseph Barrans, of St. Paul's, Deptford, in the county of Kent, engineer, for improvements in axles and axle-boxes of locomotive engines and other railway carriages. Sealed 24th November—6 months for inrolment.

Ambroise Ador, of Paris, in the Republic of France, engineer, for improvements in producing light. Sealed 24th November—6 months for inrolment.

Henry Lamplough, of Snow Hill, consulting chemist, for a new mode of supplying pure water to cities and towns. Sealed 24th November—6 months for inrolment.

James George Newey and James Newman, of Birmingham, for improvements in the manufacture of buttons, studs, and other dress fastenings and ornaments. Sealed 28th November—6 months for inrolment.

Francis Tongue Rufford, of Prescot House, in the county of Worcester, fire-brick manufacturer; Isaac Marson, of Cradley, in the same county, potter; and John Finch, of Pickard-street, City-road, in the county of Middlesex, manufacturer, for improvements in the manufacture of baths and wash-tubs or wash-vessels. Sealed 28th November—6 months for inrolment.

Frank Clarke Hills, of Deptford, in the county of Kent, manufacturing chemist, for an improved mode of compressing peat for making fuel or gas, and of manufacturing gas, and of obtaining certain substances applicable to purifying the same. Sealed 28th November—6 months for inrolment.

CELESTIAL PHENOMENA FOR DECEMBER, 1849.

D.	H.	M.	
1			Clock after the ☉ 10m. 41s.
—			☽ rises 5h. 46m. A.
—			☽ passes mer. 0h. 45m. M.
—			☽ sets 8h. 44m. M.
	6	3	♂ in conj. with the ☽ diff. of dec. 6. 30. N.
3	17	36	♃'s first sat. will im.
4	4	6	☿ in the descending node
	21	36	♄ stationary
5			Clock after the ☉ 8m. 40s.
—			☽ rises 10h. 30m. A.
—			☽ passes mer. 4h. 45m. M.
—			☽ sets 0h. 2m. A.
—			Occul. *p* Leonis, im. 10h. 40m. em. 11h. 34m.
6	6	53	☽ in □ or last quarter
	18	39	♃ in conj. with the ☽ diff. of dec. 1. 1. S.
—			Occul. Jupiter, im. 19h. 3m.
8	13	8	♃'s second sat. will im.
9			Occul. 94 Virginis, im. 10h. 0m. em. 20h. 1m.
10			Clock after the ☉ 6m. 53s.
—			☽ rises 3h. 10m. M.
—			☽ passes mer. 8h. 44m M.
—			☽ sets 2h. 10m. A.
12	7	44	♀ in conj. with the ☽ diff. of dec. 4. 6. S.
	13	58	♃'s first sat. will im.
13			Vesta in the ascending node
	16	9	♃ in □ with the ☉
	20	24	☿ in conj. with the ☽ diff. of dec. 5. 41. S.
14	3	38	Ecliptic conj. or ● new moon
	8	44	☿ in Aphelion
15			Clock after the ☉ 4m. 31s.
—			☽ rises 8h. 15m. M.
—			☽ passes mer. 0h. 36m. A.
—			☽ sets 4h. 57m. A.
—			Mercury R.A. 17h. 21m. dec. 24. 18. S.
—			Venus R. A. 16h. 12m. dec. 20. 13. S.
—			Mars R. A. 5h. 48m. dec. 26. 24. N.
—			Vesta R. A. 7h. 51m. dec. 21. 5. N.
—			Juno R. A. 13h. 7m. dec. 5. 9. S.
—			Pallas R. A. 19h. 6m. dec. 1. 38. N.
15			Ceres R. A. 20h. 4m. dec. 26. 47. S.
—			Jupiter R. A. 11h. 33m. dec. 4. 10. N.
—			Saturn R. A. 0h. 8m. dec. 1. 44. S.
—			Georg. R. A. 1h. 24m. dec. 8. 12. N.
—			Mercury passes mer. 23h. 48m.
—			Venus passes mer. 22h. 37m.
—			Mars passes mer. 12h. 9m.
—			Jupiter passes mer. 17h. 54m.
—			Saturn passes mer. 6h. 31m.
—			Georg. passes mer. 7h. 46m.
	15	42	♃'s second sat. will im.
	18	0	☽ in Apogee
17	14	43	♂ in conj. with 136 Tauri
	18	49	♂ in oppo. to the ☉
18	21	41	☿ in sup. conj. with the ☉
19	15	51	♃'s first sat. will im.
20			Clock after the ☉ 2m. 3s.
—			☽ rises 11h. 21m. M.
—			☽ passes mer. 4h. 29m. A.
—			☽ sets 9h. 46m. A.
21	9	42	☉ enters Capricornus.—Winter commences
22	7	40	☽ in □ or first quarter
	8	13	♄ in conj. with the ☽ diff. of dec. 0. 39. N.
	18	16	♃'s second sat. will im.
	21	0	♄ in □ with the ☉
23	20	7	♅ in conj. with the ☽ diff. of dec. 3. 56. N.
—			Occul. 33 Ceti, im. 10h. 51m. em. 11h. 23m.
25			Clock before the ☉ 0m. 57s.
—			☽ rises 1h. 27m. A.
—			☽ passes mer. 8h. 27m. A.
—			☽ sets 2h. 25m. M.
—			Occul. B.A.C., 845, im. 4h. 4m. em. 4h. 46m.
26	17	44	♃'s first sat. will im.
28	1	19	♂ in conj. with the ☽ diff. of dec. 7. 51. N.
	12	12	♃'s first sat. will im.
29	2	0	Ecliptic oppo. or ○ full moon
	4	0	☽ in Perigee
30			Occul. 3 Cancri, im. 5h. 58m. em. 6h. 48m.
31	0	25	☉ in Perigee
	12	0	♅ stationary

J. LEWTHWAITE, Rotherhithe.

THE
LONDON JOURNAL,
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CONJOINED SERIES.

No. CCXVII.

RECENT PATENTS.

To Francis Edward Colegrave, *of Brighton, in the county of Sussex, Gent., for improvements in the means of communicating between the passengers and guard of a railway train, or between the guard and engine-driver; parts of which improvements are also applicable to working signals on railways.*—[Sealed 22nd May, 1849.]

This invention relates, firstly, to the construction and employment of a sounding apparatus or alarum, whereby the passengers of a railway train may, when required, attract the attention of the guard, who will then proceed along the train (without, however, arresting its progress), and ascertain the cause of the alarum being sounded.

The invention relates, secondly, to the construction and employment of an apparatus, to be adapted one to each compartment of a carriage; and to be worked in such a manner that the guard, upon proceeding along the train (when the alarum has been sounded), may at once perceive in what compartment of any carriage the passenger, who has thus attracted his attention, is sitting.

The third part of the invention relates to a means of communicating between the guard and engine-driver, by the employment of an elastic tube, with a whistle at the end nearest the engine-driver,—the tube being suitably arranged for being attached and detached with facility, and so constructed that it cannot be disarranged by the lengthening or shortening of the train by the action of the buffers.

The alarum apparatus, which constitutes the first part of the invention, may, with suitable modifications, be also employed as a station signal, for making signals in case of fogs, or at night, so as to warn engine-drivers to approach the station with caution.

In Plate XVI., the alarum apparatus, for railway purposes, is shewn in several views. As the apparatus, for whatever purpose it may be employed, will be constructed upon precisely the same principle, it will not be necessary to give a detailed description of more than two arrangements,—one, when constructed upon a small scale, being applicable for railway carriages, and, when made upon a large scale, being suitable for a stationary signal for junctions, termini, and other important stations; and the other arrangement being intended solely as a stationary signal at the smaller stations, in place of the ordinary hand-bell now employed for signalling the approach of a train and giving notice to the engine-driver when to proceed after a stoppage.

Fig. 1, represents a side view, and fig. 2, an end elevation of the improved alarum, which is applicable either to a railway train or to a railway station. The framing or side standards for supporting the various working parts is shewn at *a*, *a*, and may be made of either wood or metal. The bell or alarum is shewn at *b*, *b*, and is supported upon a bracket *c*, secured by screws to the top of the framing *a*, *a*. The hammer or clapper *d*, is secured to a crank at the upper end of the vertical shaft *e*, *e*, *e*, which is mounted in bearings attached to the side standards *a*, *a*, and is furnished with two short cranks *f*, *f*. Opposite to or rather behind these cranks a wheel or star *g*, provided with two or more projecting pins *h*, *h*, *h*, (three are shewn in the drawing, but their number is not material) is mounted on one end of the horizontal shaft *i*, which turns in bearings in the side standards, and carries, at its opposite end, a small toothed wheel or pinion *j*, which gears into and is driven by a large toothed wheel *k*, on one end of the shaft or spindle *l*. At the opposite end of this shaft or spindle a band-wheel or pulley *m*, *m*, is mounted, and is driven by a band or cord *n*, *n*, which also passes round another wheel or pulley *o*, below. This wheel turns upon a horizontal pin or stud *p*, situated at the upper end of an adjustable bar *q*; the lower end of which is inserted in a socket *r*, and is secured therein by a set-screw *s*, in such a manner that, in case the band or cord *n*, should become elongated by use, it may be easily made of the required tension by merely loosening the screw *s*, and pressing down the bar *q*, in its socket *r*. A winch-handle *t*, is adapted to a square part of the pin or stud *p*, for the purpose of actuating the mechanism.

The operation of the apparatus is as follows:—Upon communicating motion by the hand to the winch *t*, the band or cord *n*, round the wheel or pulley *o*, will drive the wheel or pulley *m*, above, and, by means of the train of wheels *k*, and *j*, will actuate the shaft *i*, and star or wheel *g*, and, by thus causing the wheel *g*, to rotate and bring the projecting pins *h*, *h*, alternately against the upper and lower cranks *f*, *f*, of the vertical shaft or spindle *e*, the said shaft will be caused to turn in its bearings, and bring the hammer or clapper *d*, with a sharp rap against first one side and then the other of the inside of the bell *b*. It will be seen that, by driving the pinion *j*, by means of the large toothed wheel *k*, a very great number of strokes are given by the hammer on the bell for every revolution of the winch-handle. The number of sounds may of course be increased or diminished at pleasure, by merely altering the relative proportion of the toothed wheels *j*, and *k*, or of the band-wheels or pulleys *m*, and *o*.

In adapting this apparatus to a railway carriage, for the purposes above mentioned, the upper part of the mechanism is enclosed in a metal or other case *u*, *u*, made open at the sides, so as to allow the sound to escape;—this case, containing the mechanism, is secured to the roof of the carriage, and a hole is made therein, to allow the cord *n*, *n*, to pass down to the interior, where the pulley *o*, and winch-handle *t*, are attached to any convenient part of the carriage, in such a manner that the handle can be turned by the passengers inside, in case they may want to communicate with the guard.

In order to apply the apparatus as a stationary signal at the junctions, important stations, and termini of railways, it will be found convenient to place the mechanism on a bracket, fixed to a wall at a considerable elevation, as shewn at fig. 2, (the winch-handle *t*, and its accessories being placed below, at a suitable height to be worked by hand); or it may be mounted on a high pillar or post, specially provided for the purpose; in which case, the band or cord *n*, *n*, may be made to pass up the interior of the post; or the mechanism above may be worked by means of bevil-wheels, in connection with a long vertical shaft, enclosed within the post or pillar, as shewn in fig. 3.

The patentee remarks that, at termini, and other places where there is a stationary engine, provision might be made, if thought desirable, for working the apparatus by power; so that, in case of fogs, and at other times when it would be desirable to keep up a continuous sound or alarum for a length of time, it would only be necessary to put the driving power in gear with the apparatus, when an alarum would be sustained without the employment of manual labor.

Fig. 4, represents a modification of the apparatus to be employed at small intermediate stations, in place of the hand-bells now used, for signalling the approach or departure of a train. The apparatus is constructed upon precisely the same principle as the one above described, although the arrangement of parts is somewhat different. In this case, the mechanism is mounted on a short post or standard, so as to bring the handle *t*, (whereby the apparatus is actuated) to a convenient height for a man to work. A, A, is a strong wooden or metal post, firmly fixed in the ground; and on the top thereof the standard *a*, *a*, of the apparatus is secured by bolts, or otherwise. The bell *b*, is mounted on the end of a strong bent steel wire support *c*; and the hammer or clapper *d*, is, as in the former instance, attached to the cranked end of the vertical rod *e*, *e*, which is furnished with two short cranks *f*, *f*. The star or wheel *g*, with its projecting pins *h*, *h*, is attached to the hub of a small toothed wheel or pinion *j*; and this latter is driven by the large toothed wheel *k*, the spindle or axle of which carries the winch-handle *t*, on the other side of the standard *a*. It will at once be seen that, in order to signal the approach or departure of a train, it will only be necessary for the attendant to give the handle *t*, two or three turns, in place of running about and looking for his hand-bell, as is at present the practice.

The second part of the invention relates to the construction and employment of an apparatus, consisting of a small moveable lamp or visible signal, which, when applied to railway carriages, may be made to indicate the particular compartment of any carriage in which any person requiring to communicate with the guard is sitting. This apparatus is shewn at figs. 5, 6, 7, 8. It consists of a small lamp, suspended between two hollow columns by weighted cords or chains, which pass up and over pulleys at the upper ends of the columns. At the under part of the lamp is a vertical rod or bar, with a projecting notch formed thereon, which, when the lamp is brought down to the lower part of the apparatus, retains it there, by being held back by a spring-catch or trigger; but immediately this notch is relieved from the spring-catch, the weights, by their descent, carry up the lamp to the top of the columns. e construction and arrangement of the various parts will, however, be best understood by reference to the several figures; of which fig. 5, represents a vertical section of the apparatus, shewing the internal construction of the parts, and the mode of working the same; fig. 6, is an external elevation of the apparatus complete; fig. 7, is a plan view of the apparatus, as seen from above; and fig. 8, represents the mode of applying it to a railway carriage, in conjunction with the sounding apparatus or alarum, shewn in figs. 1, and 2, and already described. *a, a,* are the columns or standards. *b, b,* is the moveable lamp or visible signal, suspended by cords or chains *c, c,* from pulleys *d, d,* above; and to the opposite ends of these cords or chains counterbalance weights *e, e,* are attached. An arm or bar, connected to the under side of the lamp *b*, is furnished with a projecting notch or stud *f*, which, when the lamp is brought down into the position shewn in fig. 5, catches against a spring-catch *g*, in the socket *h*, and is held there, as shewn in the sectional view fig. 5. The lamp case is provided with antifriction rollers, which run against vertical guides *j, j,* and thus not only keep the lamp in a proper position, but prevent it from sticking or stopping, either in its ascent or descent. The lamp, when down in the position shewn in fig. 5, is enclosed in a box *b**, (fig. 6,) which will prevent the light from being seen. To the upper end of the spring-catch *g*, a short cord *i*, with a small ring, stud, or button at its lower end is attached, for the purpose of drawing back the catch, and freeing the notch *f*, on the projecting rod of the lamp, and allowing the same to ascend when required.

The operation of this apparatus, in conjunction with the alarum or sounding apparatus, is as follows:—When a passenger wishes to communicate with the guard, he must give the winch *t*, (fig. 8,) of the sounding apparatus two or three turns; this, by means of the cord *u, u,* will put the sounding apparatus in motion, and produce an audible signal, which will be distinctly heard by the guard, even when the train is in rapid motion; as he will generally be behind the alarum, and the sound will be sure to travel to him, as the apparatus is placed on the top of the carriage, as seen at fig. 8. Having thus attracted the attention of the guard, the passenger must pull down the cord *i*, of the visible signal apparatus, and, by thus relieving the projecting notch of the bar or rod *f*, from the spring-catch *g*, the lamp *b*, will be immediately drawn up by the weights *e, e,* into the position shewn at fig. 6; and this apparatus being also on the top of the carriage, the guard will at once see to which compartment of any carriage he must direct his attention. In order to replace the lamp in the position shewn in fig. 5, it will only be necessary to turn the small winch-handle *w*, and the lamp will be drawn down by the cord *s*,—one end of which is attached to the lower extremity of the bar *f*, and the other to a small barrel *x*, as shewn in the figures. When drawn down, the lamp will, as before stated, be held in that position by the spring-catch *g*, until again relieved from the same. The patentee remarks that one of these apparatus is to be adapted to a convenient part of the roof of every compartment of each carriage; and it should be so arranged as to admit of the lamp *b*, when elevated, being seen above any luggage that might be placed on the roof; but it will not be necessary to have more than one sounding apparatus for each carriage, as cords or bands *u*, *u*, may be conveyed therefrom to each compartment, and worked by winches *t*, *t*, as shewn in the drawing. He further remarks that, if thought desirable, the two apparatus may be made to work simultaneously; so that when any person turns the handle *t*, of the sounding apparatus, the lamp *b*, of the visible signal should be released and allowed to ascend.

At fig. 9, a means of applying the improved visible carriage signal to the purpose of a large visible signal for stations is shewn. Instead of the present tedious method of raising a signal lamp to a great elevation, the lamp is suspended, by means of cords or chains from pulleys, placed at or near the top of a column, and carrying counterbalance weights at their other ends. The means of drawing down the lamp *b*, is similar to that just described, viz., by means of a cord or chain *s*, attached at one end to the under side of the lamp, and at the other to a barrel *x*, round which the said cord or chain is wound by means of the winch-handle *w*, below. When the lamp is brought down, it is retained there as long as may be necessary by means of a pawle or click and ratchet-wheel *y*, on the axle of the barrel. A small brake-wheel *z*, is also mounted on the same shaft as the barrel; and, when the lamp is required to be raised, the ratchet-wheel *y*, must be relieved from its click, and the weights will, by their descent, cause the lamp to rise rapidly;—the speed may, however, be regulated by the brake-wheel.

The last part of the invention relates to the means of communicating between the guard and engine-driver, and consists in the employment of an elastic tube, made of coiled steel wire, covered with vulcanized caoutchouc, and furnished at the end nearest the engine-driver with a whistle, and terminating at the opposite end in a chamber, furnished with a blowing machine or air-pump. This flexible communicating pipe is intended to be carried along the top of the carriages, either inside or out, and should be made in such a manner as to admit of its being elongated one-fourth of its length (when required) without the risk of breakage or injury. The ends of each section belonging to every separate carriage are screwed, so as to admit of their being inserted in a socket; so that, when joined together, they may form a continuous pipe from the guard to the engine-driver. Fig. 10, shews the method employed for carrying out this part of the invention. A, is the elastic and flexible communicating tube, made, as before mentioned, of coiled steel wire, covered with vulcanized caoutchouc; B, is a box or wind-chest, with flexible sides, and furnished at bottom with a valve *v*, opening inwards. This box or chest contains a strong coiled steel spring, which has a tendency to keep the box or chest always extended. A whistle, of the ordinary construction used on railways, or any other of a suitable kind, is attached to the other end of the pipe A. It will therefore be seen that, whenever the top or lid of the wind-chest is depressed, a column of air will be forced along the pipe A, to the whistle, which will thus be made to give out a shrill sound in the immediate vicinity of the engine-driver. When the apparatus is out of use, the lid or top of the chest may be kept down by a lever, strap, or other convenient means. Figs. 11, represent a sectional view of the screw-joint, whereby the several lengths of elastic tube are connected together, to form one continuous length.

The patentee claims, as his invention, First,—the sounding apparatus or alarum, shewn and described at figs. 1, 2, 3, and 4, and actuated by hand labor or steam power, in place of clockwork or springs (or any mere modification thereof), consisting of a bell and striker or hammer, actuated by pins or studs on the face of a wheel or star, or arranged round an axle in such a manner as to act against cranks on the hammer-shaft,—such mechanism being worked by gearing, actuated by hand labor or steam power, so as to cause the said hammer to strike against the sides of a bell, and emit sounds in rapid succession for any continuous length of time that may be desired. Secondly,—the construction and application to railway purposes of a visible signal, such as that shewn at figs. 5, 6, 7, 8, and 9, (or any modification thereof), consisting of a moveable lamp or visible signal, which may be moved up and down, when required, by means of cords and weights, as shewn and described; also the application of this apparatus, in conjunction with the sounding apparatus or alarum above mentioned, to railway carriages, for the purpose of not only attracting the attention of the guard of a railway train, but also directing him to any carriage, and any particular compartment of the carriage, where his presence may be required. Thirdly,—the use of an apparatus (for attracting the attention of the engine-driver), consisting of an elastic and flexible tube, made of coiled steel wire, covered with vulcanized caoutchouc, and having at one end a whistle, and at the other end a blowing apparatus, for forcing air or wind along the pipe or tube, to blow the whistle.—[*Inrolled November,* 1849.]

To William Henry Burke, *of Tottenham, in the county of Middlesex, manufacturer, for improvements in the manufacture of airproof and waterproof fabrics, and in the preparation of caoutchouc and gutta-percha, either alone or in combination with other materials; the same being applicable to articles of wearing apparel, bands, straps, and other similar useful purposes.*—[Sealed 26th April, 1849.]

The first part of this invention relates to the treatment of caoutchouc (India-rubber), or caoutchouc and gutta-percha combined, with a certain material or materials, to be hereinafter mentioned, for the purpose of manufacturing a compound, which, by retaining its elasticity under all ordinary temperatures, will be suitable for waterproofing, and for being made into bands, straps, and a variety of other articles, for which India-rubber or gutta-percha are employed. This object has been heretofore attained by manufacturing the substance termed "vulcanized" India-rubber. In this process a large quantity of free sulphur is mixed with the India-rubber, and the mass is afterwards submitted to the influence of a high temperature;—the ultimate effect being apparently the combination of a portion of the sulphur with the India-rubber.

From the nature of the process used in its preparation, the vulcanized India-rubber is subject to two great defects: firstly, in consequence of the sulphur being employed in a free state, a portion of that substance is continually efflorescing,—thereby covering the surface with a white powder, and imparting a sulphurous odour to every object with which it is brought in contact; and secondly, the sulphur, by this efflorescence, is liberated from the India-rubber, and is dissipated and lost, leaving the India-rubber partially rotten, or rather disintegrated.

The material, manufactured according to the first part of the present invention, is not liable to these defects; for it is not prepared with free sulphur, and therefore the unpleasant efflorescence of that substance is avoided; and, as the material does not contain any substance of an efflorescent nature, it will remain, throughout any length of time, in its normal state.

In the preparation of his new waterproofing or elastic compound, the patentee employs a compound of antimony, obtained in the manner following—but it may be obtained by other processes, well known to manufacturing chemists:—The substance known in commerce as crude antimony is reduced to a fine powder, either by pounding or grinding; one part of this powder is added to about 25 parts of crystallized carbonate of soda, or 20 parts of carbonate of potash, dissolved in 250 to 300 parts of water; the whole is boiled in an iron boiler, during half or three-quarters of an hour; at the expiration of which time the boiling is stopped, and the undissolved matter allowed a few minutes to precipitate. The supernatant fluid is run off hot, and the alkali is saturated by hydrochloric acid, added in slight excess; whereby a copious orange-red precipitate is at once formed. This precipitate constitutes the golden sulphuret of antimony, or, as termed by some, Kerme's mineral; and it is the antimonial compound already mentioned, as the material to be combined or mixed with the India-rubber. The red precipitate is well washed with hot water, to remove the excess of acid; it is then to be dried at a low temperature and ground, when it will be fit for use. This antimonial compound is mixed with caoutchouc, alone or in combination with gutta-percha (according to the degree of elasticity which the caoutchouc is required to possess), and the mixture is afterwards subjected to a heated temperature, varying from 250° to 280° Fahr., either in a heated stove or boiler under steam pressure; or it may be exposed to the action of the sun's rays. Caoutchouc, when thus prepared, will be greatly improved, not only in strength and elasticity, but will be capable of resisting the heat of the sun, and of retaining its softness and pliability at a low temperature.

To make a block of caoutchouc, intended afterwards to be divided into sheets, threads, straps, or bands, the patentee takes any given quantity of the ordinary India-rubber of commerce, according to the size of the block intended, say 100 lbs. weight, which, being well washed and freed from all extraneous matter, is passed through a pair of crushing-rollers, and afterwards put into a masticator (a box, with a steam-tight jacket, having a fluted roller fixed in bearings and revolving within it). To this box heat is applied, and rotary motion is given to the roller. The antimonial compound is then added, in quantities varying from 5 to 15 lbs., according to the strength and elasticity required in the block of caoutchouc, and the purpose for which it is intended to be used. When the ingredients have been thoroughly mixed in the masticator (which will require from one and a half to two hours), the compound is removed from the box, and, while in a warm state, it is compressed, by means of screw or hydraulic pressure, into an iron mould, varying from 2 to 6 feet in length, 1 foot wide, and 10 inches deep. The block, thus formed, after being under pressure from one to two days, is subjected to a steam heat, at the temperature before stated, for the space of from two to three hours. This block, which has now acquired the properties of permanent elasticity, and increased strength of fibre, as before mentioned, is cut into sheets, which may be afterwards divided into thread, or formed into other articles, as may be required; or, if found more convenient, the block may be divided, after being taken from the mould, and the articles made therefrom may be subjected to the heating process, or to the action of the sun's rays.

When sheets of a considerable length are required (say 20 yds. or more), and it is desirable to avoid the expense of machinery for cutting the same, they may be obtained by dissolving the caoutchouc in the usual way, in any of the known menstruums, directly after being taken from the masticator, and spreading the pulp or solution, by means of calender-rollers, or the usual spreading machine, upon calico or other cloth, previously coated with ground chalk, fullers'-earth, or pipe-clay, which will allow the caoutchouc to be easily separated from the cloth, after it has undergone the heating process. But when it is desired that the composition should firmly adhere to the cloth, leather, or other fabrics that may be required for airproof or waterproof purposes, the saturating with chalk, &c., must of course be omitted: coloring matter may then be added, if required.

From the above description it will be obvious that the improved caoutchouc compound, either with or without the addition of gutta-percha, is applicable to the various purposes to which caoutchouc or compounds of caoutchouc have heretofore been applied: it will therefore be unnecessary to enumerate them here. One of the purposes to which the patentee proposes to apply this compound with an increased advantage is the uniting of cotton fleece to other bodies, or cementing two or more fleeces together, as set forth in the specification of a patent granted to him on the 20th day of January, 1846; for by this means he is enabled to produce a fabric which will not be affected by the atmosphere. By the use of this improved caoutchouc composition, he states that he is enabled to produce a cheap and durable waterproof fabric, suitable for printers' blanketing, the backs of wire cards, &c.

The second part of the invention refers to the manufacture of waterproof cloths or garments, known as single textures, and consists in removing the shiny or polished appearance of the surface thereof, which is very generally objected to, from its resemblance to common oiled or painted cloth. To effect this improvement, from 10 to 15 per cent. of ground silk, cotton, or wool (after the manner of flock) is mixed with caoutchouc, either prepared as above or not, and the caoutchouc is dissolved in a suitable menstruum; or the flock may be added to the caoutchouc when dissolved. With this solution the surface of the cloth, which was previously prepared with the waterproof composition in the ordinary manner of such manufacture, is coated; and to the waterproof surface an appearance greatly resembling woollen cloth is thereby imparted to the fabric. This cloth may be afterwards put through the heating process, and another cloth or fabric cemented thereto, as a lining, if required. The patentee states that he is aware that flock has heretofore been united to cloth, paper, and other fabrics, by means of India-rubber solution and such like adhesive matter, by sifting the flock in a dry and powdered state on to the fabric; but the flock, when thus applied, may be easily removed by friction, as it has but a slight hold upon the body of the fabric,—but, according to his improvements, the flock is made an integral part of the fabric itself, and cannot therefore be removed.

The third part of the invention refers to the manufacture of bands or straps for driving machinery. A general complaint against the use of gutta-percha machine bands has arisen, in consequence of their stretching after being a short time in use, as well as their chafing and fretting away when driven with great speed, owing to the gutta-percha not being sufficiently hard to resist the friction of the drums or pulleys over which they pass. To remedy this defect, the patentee proposes to apply to such bands, either at the centre or on one or both sides thereof, leather or canvass, or other strong fabric, adapted for the purpose, and to cover one or both of the gutta-percha surfaces with the improved preparation of caoutchouc, or of caoutchouc and gutta-percha combined: by which means a band of limited elasticity, and possessing the necessary hardness of texture, will be obtained, with the advantage of its having a cemented flush or smooth lap-joint, which is so desirable in driving-bands.

The fourth head of the invention refers to an improvement in the manufacture of boots and shoes. In the soling of boots and shoes gutta-percha has proved a good substitute for leather; but, as regards the heels, it has proved less effective, in consequence of the latter being subjected to greater friction than the former. Under this head of his invention he proposes to case the outer edge of such heels with metal, after the manner of tips, as also the toes and sides of the soles, when exposed to excessive or hard wear. These tips or shields of metal are moulded in with the heels and soles when the gutta-percha is in a plastic state; and, by forming countersunk holes in the tips, guards, or shields, or forming on the inner face thereof suitable projections, the gutta-percha will imbed itself in and around the tips or shields, and hold them firmly in their place.

The patentee claims, Firstly,—the treatment of caoutchouc, or caoutchouc and gutta-percha combined, with the preparation of antimony, as above described. Secondly,—combining ground silk, cotton, or wool, with caoutchouc, and finishing waterproof cloths or fabrics therewith, as above described. Thirdly,—the manufacture of driving-bands and straps as above set forth. And, Fourthly,—the application of metal guards, tips, or shields, to gutta-percha heels and soles of boots, as above described.—[*Inrolled October,* 1849.]

To François Vouillon, *of Princes-street, Hanover-square, in the county of Middlesex, manufacturer, for improvements in making hats, caps, and bonnets.*—[Sealed 28th March, 1849.]

This invention relates to the manufacture of that description of hats, caps, and bonnets, which are made from felt, leather, or other similar material or fabric, and consists in the employment of a peculiar construction of machinery or apparatus, whereby the manufacture of these articles will be much facilitated. According to the ordinary mode of carrying on this manufacture, a piece of felt or leather, previously cut to a suitable shape and dimensions, is soaked in water, and then, by hand labor, is forced over a block, of suitable form, according to the article intended to be produced; and, when the fel has been properly stretched over the block, it is tied, or otherwise fastened thereon, for a sufficient length of time to set the shape. It usually requires some time to perform this stretching operation by hand; and it is for the purpose of facilitating this part of the manufacture that the apparatus forming the subject of this invention is employed.

In Plate XVII., fig. 1, represents a side elevation of the machine or apparatus; fig. 2, is a transverse vertical section of the same, shewing the manner of stretching, over the shape or block, the felted cloth or leather, of which the hat or other article is intended to be made. The apparatus consists of a cylinder, box, or case *a, a,* made of brass, copper, or other suitable material, and furnished at or near its bottom with a steam-pipe or pipes *b,* which admit steam from a boiler to the interior of the case *a*; and, in order that the steam may issue therein in a divided state, and be properly diffused throughout the box, a disc or plate *c,* is secured, by means of a screw, to a stud or block at the bottom, leaving only a narrow space between the disc *c,* and the bottom of the case. The block or shape, upon which the hat, or other article intended to be produced, is made, is shewn at *e, e.* It is constructed of wood, covered with sheet-copper, or brass, or other suitable materials, and is furnished with a dovetailed stud or catch-piece, whereby it is suspended from the revolving holder *f,* as shewn best at fig. 2. This holder *f,* is suspended from the lower end of a screwed rod *g, g,* which passes through a female screw *h,* at the upper end of the standard A. A hand-wheel *i,* is mounted on the upper end of the screwed rod *g,* for the purpose of turning the same, when required, to raise or lower the shape or block *e.* In order also to facilitate the operation, a weighted chain or cord *j,* passes from the upper end of the screwed rod *g,* over a pulley, not shewn in the drawing, but placed in any convenient locality.

The felted fabric or other material, of which it is intended to make a hat, cap, bonnet, or other similar article, is steeped or soaked in water in the usual manner, and is then strained over the circular brim-shape *k.* The felted material is secured on this brim-shape by means of a metal band *l,* which is made to surround the brim-piece *k,* and hold the felt in contact therewith by means of a tangent-screw *m,* (as shewn in fig. 1.), by tightening which, the belt is firmly held while the stretching operation takes place. The felt being thus strained over the brim-piece, the latter is placed (with the felt uppermost) on the upper edges of the steam-box or case *a,*—a groove being made all round the under side of the brim-piece *k,* to receive the edge of the case *a*, so as to allow the brim-piece to be turned round on its edge if required. It will of course be understood that, previous to fitting the brim-piece in its place on the steam-box or case *a*, the shape *e*, is raised out of the way, as shewn at fig. 1. The several parts of the apparatus being in the position shewn in this figure, steam is admitted into the case *a*, (by turning a cock on the pipe *b*,) and allowed to act upon the under side of the felt until it has thoroughly warmed it; the shape *e*, is then gradually brought down on the strained felt by turning the hand-wheel *i*, and, by its descent, the strained felt is forced through the centre opening of the brim-piece *k*, and caused to assume the shape shewn at figs. 2, and 3. Any condensed steam or water which may be at the bottom of the case *a*, may be run off through the pipe *b**. When the stretching operation is completed, the brim-piece *k*, with the felt and the block *e*, therein, is removed from the machine, and a fresh block *e*, and brim-piece *k*, placed therein instead of those just removed. Previous, however, to removing the brim-piece and block from the machine, they must be secured together, in order that they may be all taken out at the same time, with the piece of felt stretched between them. In order to connect these two parts together, a cramp or hooked bar *n*, (shewn detached at fig. 4,) is employed. This cramp is made of galvanized iron, or of brass, or other suitable substance which will not injure the felt by rusting; and, by passing the hooked ends of the bar *n*, under the edges of the brim (the other parts passing over the upper side of the block *e*, as shewn at fig. 2,), the block is prevented either from falling out or being forced out by the elasticity of the felt, and may therefore be easily removed from the machine. The several parts, thus connected together, as shewn at fig. 3, are then left until the felt has become dry and the shape properly set.

In order that the felted fabric may not be stained or injured by the rust of iron, the several parts of the apparatus, with which the felt is likely to come in contact, are made of some metal or material that is not liable to be injuriously acted upon by water or damp.

The patentee claims—securing the felt or other material, of which the hat, cap, or bonnet, is to be made, to a brim-shape, and causing a block to enter the circular opening of the brim-shape, and thereby force or stretch the felt, or other material, over the same, and thus produce a shape that may, according to the block that is used, be made into a hat, cap, or bonnet, as may be required.—[*Inrolled September*, 1849.]

To William Edward Newton, *of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, civil engineer, for improvements in machinery for the manufacture of net, lace, or other similar fabrics,—being a foreign communication.*—[Sealed 16th April, 1849.]

The patentee, before describing the nature of the invention communicated to him by his foreign correspondent, makes the following preliminary remarks:—Hitherto the threads of textile or fibrous substances, such as silk, flax, or cotton, which have been used as the chain or warp in the manufacture of lace or net, have been what is technically called "warped," or arranged side by side, and then wound upon a cylinder, which, being mounted upon an axle or shaft, delivers the warp-threads as each mesh of the net or lace is formed. By this arrangement of the warp-threads, whatever may be the difference in the consumption of the several threads, or the quantity of one or more portions of the warp required to produce the pattern or fabric, in comparison with other portions of the warp, the cylinder will always deliver the same quantity in length of each thread. This gives rise to great inconvenience; as, in the manufacture of figured lace or net, it often happens that, in order to produce the work or pattern, a much greater quantity of some portions of the warp-threads is required than of others which are intended to produce a different description of work, such as plain work; and the result necessarily will be, that the several threads will not be regularly and uniformly stretched throughout the fabric.

According to the present invention, the warp-threads are so arranged as to render them independent of each other. For every thread a bobbin is provided for regulating its tension; and thus each separate thread, or any number of threads, may, without inconvenience, furnish a greater or less length of warp, as may be required.

Another inconvenience noticed by the patentee in the lace-machines now in use is, the increasing strain required, as the manufacture proceeds, for unwinding the weft-threads from their bobbins. These bobbins (which are formed, as is well known, of two little discs of plate-brass, rivetted together, with a space between them for receiving the thread) are placed in carriages, furnished with springs, which serve to regulate the tension of each thread of weft; and, by means of these springs, a given amount of tension is put upon each thread of the weft. But, as the operation of weaving proceeds, and the diameter of the coil of thread on the bobbin decreases, a greater tension must be given to the thread, to cause the bobbin to deliver the amount that a less strain would have drawn off at the commencement of the operation. From these remarks it will be evident that either the tension will not be strong enough when the bobbins are full, or it will be too strong towards the end when they are nearly empty; and it will be easily understood that this will occasion great irregularities in the operation of weaving. In order to obviate these inconveniences the inventor proposes to employ the following means for giving a uniform tension to the threads:—In Plate XVII., fig. 1, is a front elevation of part of a warp lace machine, with the various improvements adapted thereto; fig. 2, is a transverse vertical section of the same, shewing more clearly the internal construction and arrangement of the various parts. One of the principal parts of the invention consists, as before mentioned, in dispensing with the use of the ordinary warp-beam, and employing, in place thereof, a number of flat plates *a, a,* upon or around which the warp-threads are wound separately; so that all the threads are distinct and independent of each other. These plates are made slightly conical, with their upper ends rounded to prevent their interfering with the delivery of the warp-threads, as the operation of weaving proceeds. The lower ends of these plates are inserted in the interstices of what may be termed a comb-box, as it consists of a number of metal plates *b, b,* arranged side by side in a metal or other box *c, c,* which is attached to the side framework of the machine. The arrangement of these plates is shewn best at fig. 1, where it will be seen that when the plates *b,* are arranged side by side in the box *c,* a narrow space or slit will be left between them at their upper parts, which are cut away or made thinner for this purpose, so as to receive the lower ends of the plates *a, a.* The warp-threads from the plates *a,* pass through holes made in the metal plate *d*; and, after being wound three or four times round the regulating bobbins *e,* pass through another metal plate *g,* to the upper part of the machine. The regulating bobbins *e,* are each mounted in a carriage or frame *f,* as shewn upon an enlarged scale at fig. 3, and are furnished with a spring, for the purpose of giving to the warp-threads the required amount of tension while being drawn off the bobbin. A small hole is made in the lower side of the carriage, for the purpose of allowing the thread to pass through from the plates *a, a,* to the regulating bobbins *e.* The regulating bobbin carriages *f,* are suspended by the warp-threads between the plates *a,* and *g*; which latter prevent the bobbins from rising too high or falling too low. The carriages *f*, are also separated laterally from each other by vertical wires or partition-bars *h*, which extend from the plate *a*, to the upper plate *g*. A metal bar *i*, extending from end to end of the machine, serves as a support to the plates *a*, and *g*, which are attached thereto; and a long bar *j*, is secured to the under side of the plate *a*; its edges being covered with cloth, felt, or some other similar material; so that as the warp-threads bear or press against the edges of the bar *j*, they are prevented from delivering too freely, and are kept at their proper tension. The warp-threads are pressed against, and kept in contact with, the covered edges of the bar *j*, by the long narrow presser-bars j^1, j^1.

At *k*, *k*, fig. 2, an improved description of bobbin-carriage is shewn, which carries an ordinary bobbin to contain the weft-thread, and a regulating bobbin to impart a uniform tension to the weft-threads. This improved bobbin-carriage, with the regulator attached, is shewn upon an enlarged scale at fig. 4. As long as any thread remains on the improved bobbin (that is to say, from the time that the bobbin is full of thread until it has been emptied, or nearly so) the tension will always be uniform. The weft-threads ought to be wound four, five, or six times (more or less, as may be thought desirable) round the regulating bobbin, which, by means of a spring, placed in the upper part of the carriage, admits of imparting a greater or less amount of tension, and the regularity of the tension is occasioned only by a few turns of the weft-thread round the interior circumference of this regulating bobbin. From what has been said, it will, of course, be understood that this bobbin never, at any given time, contains more thread than at another time; for as it furnishes thread to the machine during the operation of weaving, so it receives the same quantity from the ordinary bobbin placed beneath it in the same carriage. The fabric, as it is manufactured, passes upwards over a breast-beam or roller, and under the large work-roller *l*, at the back of which is a pressing-roller *m*, mounted in the arm *o*. In order to prevent the fabric from slipping between these two rollers, they should be covered with caoutchouc, gutta-percha, or some elastic fabric, such as felt, cloth, or knitted fabric; and the roller *m*, is kept in contact with the roller *l*, by means of an adjusting screw *q*, whereby the two rollers may be pressed, with more or less force, against each other. The work passes from between these two rollers to another roller *n*, which is mounted in bearings at the end of the arm or support *p*, and is intended to wind up the work. The roller *l*, is actuated by gearing, in connection with the working parts of the machine, in the ordinary manner; and the roller *m*, is driven by friction of contact with the roller *l*; the roller *n*, is actuated by a strap or band coming from the roller *m*, or it may be driven by friction of contact with the roller *m*, or by being put in gear with the roller *l*. By this arrangement of parts, the meshes of the net or fabric and the pattern will always be of the same size at the end as at the beginning of the piece; as the rollers *l*, and *m*, which always preserve the same diameter, only act as drawing-rollers, to take up the work as it is made, and deliver it to the taking-up or work-roller *n*, which does not affect either of the other rollers.

The patentee claims, Firstly,—dispensing with the use of the ordinary warp-roller, and, in place thereof, arranging the warp-threads separately and independent of each other, so that varying quantities of the several warp-threads may be used as required, without affecting the tension of the contiguous warp-threads. Secondly,—the use of the regulating bobbins *e*, fig. 3, or any similar contrivance, for regulating the tension of the warp-threads and keeping it always uniform. And, Thirdly,—the mode shewn at fig. 4, and at *k*, *k*, fig. 2, or any modification thereof, for regulating the tension of the weft-threads and keeping it uniform throughout the whole piece.—[*Inrolled October*, 1849.]

To Gustave François Picault, *of Rue Dauphin, Paris, in the Republic of France, cutler, for improvements in apparatus for opening oysters.*—[Sealed 7th June, 1849.]

In the ordinary mode of opening oysters a knife is inserted between the two shells, at the front part thereof, and by this means they are separated, leaving the oyster adhering to the flat shell. Now this invention consists in forming an apparatus for opening oysters, by combining a stop or instrument for receiving or holding the oyster with a cutter or knife, and with suitable mechanical contrivances for actuating the same,—such cutter or knife being caused to enter the oyster at the back or joint and separate the two shells; at the same time dividing the oyster from the flat shell, and leaving it in the deep or concave shell.

Various modes of constructing the apparatus may be adopted; but the patentee prefers the form represented in Plate XVII., where fig. 1, is a plan view of the apparatus in the position for opening an oyster; fig. 2, is an edge view thereof; and fig. 3, is a transverse section of the apparatus when nearly closed. *a*, is the part of the apparatus which holds the oyster; and *b*, is the cutter or knife, affixed to the part *c*. The parts *a*, and *c*, are jointed together by a pin *d*, the lower end of which forms a leg to support the apparatus; and the parts *a*, and *c*, are each provided with a leg *e*, for the like purpose: it is stated that when the apparatus is made of a suitable size for very large oysters, small wheels may be applied to the lower ends of the legs *d*, *e*, to facilitate the movements of the parts *a*, *c*. The action of the apparatus will be readily understood on examining fig. 1: the oyster is placed with its front edge in the hollow part *a*; the corner of the cutter or knife is applied to the joint of the oyster, in the manner shewn; and then the parts *a*, *c*, being caused to approach each other, by pressure on the handles *f*, *f*, the point of the cutter *b*, will separate the shells at the joint, and the cutting edge thereof will divide the oyster from the flat shell. Although both the parts *a*, and *c*, are represented to be moveable, yet one may be fixed on a counter or other surface; and in this case the patentee prefers that the part *a*, should be the fixed or stationary one.

The patentee states that he does not claim any of the abovementioned parts separately; nor does he confine himself to the above details; but he claims the mode, above described, of combining parts into one apparatus for opening oysters.—[*Inrolled December*, 1849.]

To MICHAEL JOHN HAINES, *of John-street, Commercial-road East, in the county of Middlesex, leather pipe maker, for improvements in the manufacture of packing for steam-engines' cylinders, and other purposes; part of which improvements are applicable to the manufacture of waterproof fabrics and leather.**—[Sealed 14th June, 1849.]

THIS invention consists in manufacturing packing for the pistons, stuffing-boxes, and other parts of steam-engines, and for other purposes, by cementing, or otherwise combining together, as many thicknesses of fabrics, made of fibrous materials, as will be sufficient to produce a packing of the required size.

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* By a disclaimer, dated 14th December, 1849, the patentee has struck out the words "part of which improvements are applicable to the manufacture of waterproof fabrics and leather" from the title of his patent.

The fabric which the patentee prefers to use is strong canvass; although other kinds of fabric may be employed. The packing may be made of various forms; but those which the patentee prefers are shewn in Plate XVII. Figs. 1, represent plan and edge views of a packing for a piston, composed of several thicknesses of fabric, cemented together parallel to the axis or central line of the piston; and figs. 2, exhibit a similar packing, formed by cementing together a series of layers of fabric, placed horizontally or at right angles to the central line of the piston. Figs. 3, shew a packing for a stuffing-box, which is made by winding the fabric around a cylinder; but this packing may be formed by cementing together numerous layers of fabric, situated horizontally or at right angles to the axis of the piston. An inclined cut is made through one side of the packings shewn at figs. 1, and 2, in order that, as the packing wears away, it may be expanded to the required diameter. A helical cut is made through the packing represented at fig. 3, so that the packing may be contracted when it becomes worn.

The cement employed for combining the pieces of fabric should be capable of withstanding the action of any fluids to which it may be exposed. For packings which are to be subjected to the action of steam, hot water, spirits, or spirituous vapours, the patentee states that he employs a cement composed of two parts of India-rubber, dissolved in turps (in the proportion of one pound of India-rubber to six pounds of turps), one part of gum "thus," dissolved in rectified turps (in the proportion of six pounds of the gum to three quarts of turps), one part of gum-damar, jandrae, or juniper, dissolved in rectified naphtha (in the proportion of one pound of gum to two pounds of naphtha), and one part of gum " Seymour" or mastic, dissolved in naphtha (in the proportion of one pound of gum to two pounds of naphtha).

In conclusion, the patentee claims "the manufacture of packing for pistons of steam-engines, cylinders, and other purposes; and also the manufacture of the packings for stuffing-boxes of steam-engines, cylinders, and other purposes where the rods or instruments move in or through the packings."—[*Inrolled December,* 1849.]

To Elizabeth Oudinot Lutel, *of Addle-street, in the City of London, for producing a certain texture, elastic in some parts,—being a communication.*—[Sealed 28th January, 1847.]

This invention consists in the manufacture of a texture, elastic in some parts (to be used in making corsets, belts, stiffeners, &c.), by the introduction of elastic threads, either as warp or weft. In the first case, the patentee introduces amongst the non-elastic threads of the warp a certain number of elastic threads, prepared by the usual mode,—the number of these elastic threads being regulated by the width of the tissue, and the use to which it is intended to be applied, so as to produce the elasticity in a part only of the width. When the elastic threads are to form part of the weft, she first weaves a certain extent of the tissue with non-elastic weft-threads, and then, by means of a shuttle, she forms another part with elastic threads.

The above modes of weaving are applied to the manufacture of a double tissue. This is obtained by the process commonly employed for producing a double tissue, *i. e.*, by employing a double warp, passed through a double harness, provided with supplementary stitching-treadles. The double tissue is rendered elastic in some parts, either by the introduction of elastic threads amongst the non-elastic warp-threads, or else by employing elastic threads as weft-threads. The patentee states, that she operates alternately on each of the two warps, which are united at the desired distances by the operation of the stitching-treadles. This double tissue is intended to be used for making stiffeners, belts, corsets, &c., especially corsets, as the wearer will be enabled to contract the waist to the required degree, and yet, at the same time, the article will be elastic, and thereby relieve the body from any injurious pressure.

The patentee says she is aware that a single cloth, elastic in some parts, has been already made; therefore she does not claim such cloth; but what she does claim is, the producing of a double texture, elastic in some parts, as above described.—[*Inrolled July,* 1847.]

To Peter William Barlow, *of Blackheath, in the county of Kent, civil engineer, for improvements in parts of the permanent ways of railways.*—[Sealed 14th June, 1849.]

This invention consists, firstly, in casting two or more railway chairs or supports, or two or more parts of chairs or supports, combined with one plate or piece of metal, which will not only keep the chairs in the required positions, but will also serve as a substitute for the ordinary bearer or sleeper; and secondly, in casting chairs, which are to be fixed to wooden or other sleepers, in two pieces.

In Plate XVIII., figs. 1, and 2, are transverse sections of two chairs and bearers or sleepers constructed according to the first part of this invention; and fig. 3, is a side view of an intermediate bearer or sleeper and a joint bearer or sleeper. The intermediate ones are cast with two chairs thereon; but the joint bearers or sleepers are cast with three chairs; so that the end of each rail, besides being secured in the central or joint chair, will also be secured in another chair, cast upon the same bearer or sleeper; and thus the rails will be more securely retained in the desired positions. In figs. 1, and 2, the rails are fixed in different ways; but the chairs are similar in other respects: at fig. 1, there is a wooden key *a*, beneath the rail; and at fig. 2, a metal plate *b*, of a wedge-shaped section, is inserted between the jaw of the chair and the rail,—such plate being sufficiently long to extend between two or more chairs, cast on the same sleeper. Other means of fastening the rails may, however, be used.

Instead of making the two or more chairs and their bearer or sleeper in one casting, these parts may be made in two castings, each consisting of one part or half of the bearer or sleeper and parts of two or more chairs; so that when they are placed on each side of a rail and suitably combined, the rail at such point will be supported by a cast-iron bearer or sleeper and two or more chairs, divided longitudinally, but being in other respects similar to the sleepers and chairs above described.

Fig. 4, is a transverse section of such an arrangement, wherein the parts are combined together by means of transverse iron ties *c*, which extend through the two parallel sleepers or bearers of a line of railway, and are affixed thereto by rivets or bolts *d*. Fig. 5, shews another mode of connecting the parts by means of bolts *e*, which pass through the lower portions of the chair;—*f*, is the transverse tie which connects the two parallel sleepers and preserves the gauge of he railway.

The second part of this invention relates to the manufacture f chairs which are to be affixed to the ordinary sleepers, and nsists, as above stated, in making the same of two castings. ig. 6, exhibits a chair which is cast in two pieces; and these are connected together by bolts *g*. The form of chair may be varied; as the only difference between the chairs manufactured according to this invention and those made in the ordinary manner consists in the former being cast in two pieces instead of one piece.

The patentee claims, Firstly,—the combining two or more chairs or supports, or two or more parts of chairs or supports, with a bearer or sleeper in the same casting, as above explained. Secondly,—the making of chairs, which are to be fixed to sleepers, each of two castings, as described.—[*Inrolled, December*, 1849.]

To JOHN DEBELL TUCKETT, *of Plymouth, in the county of Devon, merchant, for a new and improved method of preparing a manure called superphosphate of lime.**—[Sealed 18th October, 1849.]

THE patentee commences his specification by stating that bones and other phosphoric animal substances have been heretofore used as manures; but, to the best of his knowledge, such substances have either been applied in a chemically undecomposed state, in which their action on the soils to which they have been applied has been slow and imperfect; or, if such substances have been employed in a decomposed state, such decomposition has been effected by the use of sulphuric or other strong acid,—which acids are costly, and the manure produced by their use contains a smaller proportion of phosphate of lime than that prepared according to this invention.

Now, this invention consists in decomposing bones, and other animal substances containing phosphate of lime, in the following manner,—the apparatus employed for the purpose being shewn in Plate XVII., and consisting of two steam-digesters *a, a,* and a boiler *b*, with suitable connecting-pipes, cocks, &c.:—The bones, bone-dust, horns of cattle, or other animal substances containing phosphate of lime, are introduced into each digester through a man-hole at the top; and then steam is admitted from the boiler *b*, by turning the cock *c*. The steam is used at a pressure varying from 29 lbs. to 100 lbs. on the square inch, according to the nature of the substances to be decomposed and of the products to be obtained: for bones of ordinary quality steam at a pressure of 50 lbs. to the inch will be sufficient; but horns will require steam at a pressure of about 70 lbs. The application of steam is to be continued until the fat and oil in the bones, or other substances, are separated and discharged therefrom (which will generally be effected in about two hours); and then the steam is to be discharged through a pipe *d*, at the hind end of the digester, and the fat and oil drawn off by a cock at the side of the same. After this, steam at a greater pressure is to be introduced until the gelatine is dissolved, and the bones, or other substances, have become more friable; and then the steam is permitted to pass off through the pipe *d*, and the substances remaining of the bones, or other matters, are to be discharged through the man-hole *e*. The patentee states that such residue may be crushed, if it be considered necessary to reduce it to a finer state of powder; and such powder constitutes the manure which he terms superphosphate of lime; but he does not allege that such powder will then consist wholly of such phosphate; for the quantity of phosphate therein will vary with the substances from which it is prepared: when prepared from bones of ordinary quality, it will contain about 85 per cent. of phosphate of lime.

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* The above is the title of this invention, as given in the specification; but the title given in the letters patent was as follows:—" A new and improved method of preparing a manure called superphosphate of lime, without using any acids in the decomposition of the various substances of which the manures now in use, and for which patents have been obtained, called superphosphate of lime, by the application of artificial agency, by which more than double the quantity of a true superphosphate of lime can be produced beyond that for which any patent has hitherto been granted, that the same may be applied in the production of all kinds of crops,—more particularly wheat, barley, oats, turnips, and other vegetables."

The patentee does not confine himself to the particular degree of pressure, provided the same be not lower than the lowest degree of pressure above specified: if the object is to obtain the gelatine in a very pure state, the pressure should be comparatively low, and, in this case, the time required for extracting it will be longer; but, if the object be to separate the gelatine in the quickest and cheapest manner, then the pressure should be high. He does not confine himself to any shape, size, or construction of digester; but he prefers to make it curved in every part, to fix suitable partitions therein, for the purpose of causing the steam to traverse over a large surface before it leaves the digester, and to introduce the steam through suitable spreading-pipes, and not in one jet or stream.—[*Inrolled December*, 1849.]

To William Edward Newton, *of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, civil engineer, for improvements in machinery for hulling and polishing rice and other grain or seeds,—being a communication.*—[Sealed 13th February, 1849.]

The improved machinery which forms the subject of this invention is shewn in various views in Plate XVII. Fig. 1, is a side elevation of the machine; fig. 2, a longitudinal elevation, with the outer casing removed; and fig. 3, a transverse section, shewing the arrangement and construction of the internal parts.

The outer case of the improved machine is cylindrical; it is lined inside with gauze, and rotates in an opposite direction to that of the inside rubber. The rice is fed into the machine between the rubber and outer cylinder from a hopper, through the end of the outer case, which is in the form of the hollow frustrum of a cone, with the smaller end outwards. The rubber consists of rows of brushes, which are so made that in their rotation they will nearly touch the wire-gauze cylinder: the space between the brushes and the wire gauze should be, as nearly as possible, one-fourth less than the average diameter of the grains of rice or other seed. The outer periphery of the brushes is slightly excentric, whereby a sufficient space is left between the ends of the brushes and the wire-gauze cylinder for the free entrance of the rice into the machine; or the edges of the brushes may be made concentric, with a portion along the forward edge, which may be cut off, to form an inclination or space to admit the rice or grain. The rice or other grain is carried through the machine by means of what the inventor denominates "inclined feeders," that is, one or more rows of paddles interposed between the rows of brushes, and projecting radially from the core, stock, or axle of the rubber. The face of these paddles is inclined to the line of the axis of the feeder, so as to act on the grain like the threads of a screw. At the feeding-in end some or all of the rows of brushes are preceded by a block of India-rubber, the periphery of which is of little less diameter than the concentric part of the brushes; their diameter being just so much less than the inner periphery of the wire gauze as to make a very slight pressure on the rice as it passes between them and the gauze cylinder; the object being to remove any portion of the hull that may remain on the grain; but if these blocks be made of sufficient length, the rice may be hulled and polished by the same machine. At the delivery-end of the machine, instead of extending the rows of brushes to the end of the rubber, they are cut off, and strips of lambs' wool, or the skin, are attached to the core of the rubber,—so that the fibres of the wool will, in their rotation, rub and press on the rice, and thus polish it. The plates forming the feeder are each jointed to the core or stock of the rubber, and also to a bar that slides longitudinally in a groove; so that by moving this bar the inclination of the feeders can be increased or decreased, to regulate the passage of the grain through the machine, and thus regulate the amount of cleaning and polishing to which the grain is to be subjected;—some qualities requiring more and some less rubbing than others. As it is important that the relative diameter of the wire-gauze cylinder and the brushes or rubbers should be well adjusted, the brushes are attached to strips or blocks connected with the core or stock by means of hinges and set-screws, or by wedges, to admit of adjustment.

In the drawings *a, a,* represents a frame, properly adapted to the purpose, but which can be altered at pleasure; and *b, b,* is a wire-gauze cylinder, the meshes of which must be large enough to permit the free escape of all the impurities, but not the grains of rice. This wire gauze is properly secured to a frame, consisting of hoops *c, c,* (see fig. 1,) and longitudinal bars *d, d,* with heads or end pieces *e,* and *f,* so as to constitute a hollow cylinder; the frame being made in two parts, divided by a plane passing through the axis, and hinged together on one side, as at *g, g,* and connected together at the other by screws or other means, so as to admit of access to the inside of the case. The head *e,* at the feeding-in end of the cylinder, consists of a ring, to the inner periphery of which is secured the base of a hollow frustrum of a cone *h,* into which the grain is fed from a hopper in any convenient manner. The other head or end *f,* extends down to, and turns on the shaft of the rubber, to be described. The wire-gauze cylinder does not, however, extend to this head, but only to the ring next to it,—thus leaving a space *i,* between the two, of sufficient capacity for the discharge of the polished rice into a delivery-case *j,* from whence it can be removed at pleasure; he bran, husks, and other impurities, that pass through the shes of the wire-gauze cylinder, being deposited in the part of this case. The outer periphery of the head *e,* is fitted run in a collar *b,* provided with friction-rollers *m;* and the er end *f,* is provided with a pulley *n,* to receive a belt from he first mover, by which it is caused to rotate in the direcion indicated by the arrow. The shaft *o,* of the rubber passes entirely through the cylinder, and has its bearings in the ends of the frame, and is provided with a pulley *p*, which is driven by a belt from some first mover, in a direction the reverse of the cylinder, as indicated by the arrows; although the two can be driven in the same direction, one faster than the other; but this will not be found so advantageous as causing them to rotate in opposite directions. On the shaft *o*, there is a stock *q*, which is made of wood or other material, and of the length of the wire-gauze cylinder; and to the periphery of this stock are secured, in a longitudinal direction, rows of brushes *r*,—the bristles being inserted in blocks of wood *s*, with one edge connected by hinges *t*, to the stock, and the other edge by screws *u*, as shewn best at fig. 3. By inserting wedges under the blocks, the diameter of the brushes can be adjusted to the wire-gauze cylinder, to regulate the distance between them. The forward edge of these brushes, that is, the edge towards the direction of rotation, should be cut off at a bevil; or the entire periphery of each segment of brushes should be excentric, as at *w*, to allow the rice to enter freely between the brushes and the wire-gauze cylinder. Two segments *x*, *x*, of the stock are not covered with brushes; and to these are fitted wings or paddles *y*, formed of sheet-metal (or other substance), and projecting radially from the surface of the stock, with their planes inclined to the axis, and their outer periphery running nearly in contact with the wire-gauze cylinder. As the brushes or rubbers rotate, it will be obvious that these inclined wings (which are denominated feeders) will catch the rice delivered by one set of brushes, and push it on towards the delivery-end of the machine before it is acted upon by the next set of brushes; and so on until it is delivered at the end in a polished state.

For the purpose of regulating the passage of the grain through the machine, as indicated above, the wings or paddles are made with a flanch a^1, fig. 2, at right angles to their plane; and this is secured to the stock by a screw that passes through the middle thereof. One end of each of these is connected by a joint link c^1, with a longitudinal bar d^1, that slides in a groove in the stock; so that, by moving this bar towards one end or the other of the stock, the inclination of the wings will be increased or decreased, and thus regulate the passage of the rice through the machine. As some kinds of grain require more rubbing than others, some means of regulating the passage of the grain is necessary.

The brushes, or some of them, do not extend the whole length of the stock. At the forward, that is, the feeding end, blocks of India-rubber, e^1, fig. 2, of the width of the brushes, are secured to the stock; their outer periphery corresponding in form with the periphery of the brushes, but being of less diameter. When this machine is used for cleaning and polishing, only one or two of these pieces of India-rubber are employed, for the purpose of removing small quantities of hull which sometimes adhere to the grains after they have passed through the hulling-machine, preparatory to the cleansing and polishing operation; but, by making these sections of India-rubber of greater length than is represented in the drawings (say double the length), the rice may be hulled in the same machine, although it may be sometimes found desirable to hull it in a separate machine.

At the delivery-end, the sections *s*, *s*, are not provided with brushes, but are covered, as shewn at f^1, with lambs' wool, prepared on the hide, for the purpose of securing them on to the stock. The fibres, from their yielding quality, should project beyond the brushes, so as to slightly press on the rice when passing through that part of the machine. The effect of this is, that a finishing polish is given to the surface of the rice. Instead of lambs' wool, other fibrous substances may be substituted; but lambs' wool has been, upon experiment, found to give the best results.

The upper part of the machine should be enclosed within a hood or cover, to prevent the escape of dust and other impurities into the room

Instead of bristles for the brushes, finely split whalebone or other substance may be substituted. The number of rows of brushes and feeders or conveyers may be increased or diminished without changing the principle of the invention. Instead of making the surface of the brushes with a bevil or excentric, to permit the rice to enter between the brushes and the wire-gauze cylinder, the stock may be made with a solid inclined plane along the forward edge of the rows of brushes.

The brush blocks, instead of being hinged to the stock at one edge, may be secured entirely by means of screws with wedges under the blocks; so that by loosening the screws and driving in the wedges, the diameter of the brushes can be adjusted; and any other means of adjustment can be substituted without changing the principle of this part of the invention.

The patentee claims, Firstly,—the employment of rows of brushes, on a rotating stock, in combination with a surrounding wire-gauze cylinder, when such rows of brushes or rubbers are made with their forward edges bevilled, or are made adjustable, so as to produce a like effect, as described; whereby the entrance of the rice or other grain between the brushes and the interior surface of the surrounding cylinder is facilitated. Secondly,—the rows of feeders or conductors in combination with and interposed between the rows of brushes or rubbers for the purpose of conveying the rice or other grain through the machine; and this is claimed in contradistinction to inclined feeders or conveyers used at the end of the brushes;—he also claims making the feeders or conveyers adjustable, in order to regulate the inclination of the faces thereof relatively to the main axis, for the purpose of regulating the passage of the grain through the machine. Thirdly,—the rubbers, made of India-rubber, at the feeding-in end of the machine, in combination with the brushes, for the purpose of hulling the grain, preparatory to the operation of the brushes. Fourthly,—the polishers, made of lambs' wool or other equivalent substance, at the delivery-end of the machine, in combination with the brushes, for the purpose of polishing the grain preparatory to its delivery. Fifthly,—connecting the brushes with the stock by adjustable means, substantially as herein described, for the purpose of adjusting the periphery of the brushes to the wire-gauze cylinder.—[*Inrolled August*, 1849.]

To JOHN HICK, *of Bolton-le-Moors, in the county of Lancaster, engineer, and* WILLIAM HODGSON GRATRIX, *of Salford, in the county of Lancaster, engineer, for certain improvements in steam-engines; which improvements are more particularly applicable to marine engines; and also improvements in machinery or apparatus for propelling vessels.*—[Sealed 28th February, 1849.]

THAT part of this invention which refers to improvements in steam-engines, although applicable for stationary and locomotive purposes on land, is more particularly adapted to marine engines for propelling vessels,—especially to the engines of vessels to be used in naval warfare, or in other service wherein it is essential that the whole of the working parts of the engine, or as much as practicable, should be placed below the level of the water, in order to decrease the liability of their being injured and disabled by cannon shot or other missiles. The improvements consist principally in a suitable construction of engine, arranged for the purpose of working two pistons in one oscillating steam-cylinder,—the rods of which pistons work through opposite ends of the said cylinder, and communicate their power directly to two separate crank-shafts, or, by means of connecting-rods, to one crank-shaft only.

The improvements in machinery or apparatus for propelling vessels apply to that class of propellers now well known as "screw-propellers," and consist in so forming each blade or vane as to have two separate and distinct angles or "pitches" of screw upon the same blade, instead of a gradually increasing or diminishing "pitch," as heretofore used in screw-propellers. The principal object of this peculiar formation of blade being, that the more oblique plane of one screw retains the water, and prevents it from escaping in a radial or centrifugal direction,—whilst the other plane acts upon the water with a propulsive force in a direct line with the shaft or axis upon which the propeller is fixed.

In Plate XVIII., fig. 1, represents a midship section of a vessel, shewing, in elevation, a pair of engines, constructed and arranged according to the present invention, for communicating motion direct to a screw-propeller; and fig. 2, is a plan view of the same. It will be evident, upon an inspection of these figures, that the elementary parts of the engine only, having reference to this invention, are exhibited. *a, a,* is the framing of the engines, supporting the two horizontal oscillating cylinders *b, b*; each being furnished with two pistons, the rods *c, c,* of which work through opposite ends of the cylinders, and communicate motion direct to the two crank-shafts *d, d.* These shafts *d, d,* are coupled by means of the connecting-rods *e,* e^1, one of which communicates motion, by means of the crank *f,* to the propeller-shaft *g, g,* (see fig. 3, which is a front elevation of the connecting-rod e^1). *h, h,* is the condenser; *i, i,* are the air-pumps; and *k,. k,* is the crank for working the same.

Fig. 4, represents, in plan view, a pair of horizontal oscillating engines, constructed and arranged for propelling by means of the ordinary side paddles; and fig. 5, shews a side elevation of the same. *a, a,* is the framing of the engine, supporting the two horizontal oscillating cylinders *b, b,* the piston-rods *c, c,* of which communicate motion to the crank-shafts *d, d*; which motion is transmitted through the connecting-rods *e, e,* and cranks *f, f,* to the paddle-shafts *g, g. h, h,* is the condenser; *i, i,* are the air-pumps; and *k, k,* are the connecting-rod and lever, for working the same.

Fig. 6, is a front view of the improved propeller; and fig. 7, is a side view of the same. *a, a,* is the propeller-shaft, upon which a long boss *b, b,* is keyed. The boss *b, b,* is furnished at each end with six arms *c, c, c,* to which the blades or vanes *d, d, d,* are rivetted, or otherwise secured, in a diagonal position, as best seen at fig. 7. *e, e, e,* are transverse stay-rods, for giving greater rigidity to the propeller. The peculiar formation or construction of the blades or vanes will be better understood by referring to fig. 8. A plate of iron, of the form shewn, is bent in the direction of the line *f, g,* until the two planes *h, i,* of the same, assume the requisite relative angle to each other, which, in the propeller shewn, is about 140°,—that being the angle which, by experience, has been found to answer best; but, of course, the angle at which the two planes of the blade are placed may be varied as circumstances may require. It will be evident, that as a propeller, so constructed, revolves, the outer plane *h,* of the blade being placed in a more oblique position, will retain the water, and prevent it from escaping in a centrifugal direction; whilst the inner or less oblique plane *i,* exerts against the water a propulsive force in a direct line with the axis or shaft *a, a.* The blades may, if preferred, be attached to the boss by only one arm each,—the arms being twisted to follow the inclination of the blades.

The patentees claim, Firstly,—with reference to steam-engines, the particular construction of engine, having two steam-pistons in one oscillating cylinder,—the rods of which pistons work through opposite ends of the said cylinder, and communicate motion direct to two separate crank-shafts, or, by means of connecting-rods, to one crank-shaft. Secondly,—with reference to the machinery or apparatus for propelling vessels, they claim the novel and peculiar construction or formation of propeller, having two separate and distinct angles or pitches of screw upon each and the same blade, without confining themselves to the particular angle which the two pitches bear to each other, the number of blades employed, or the angle which they bear to the line of propulsion.—[*Inrolled August,* 1849.]

To William Hyde Knapp, *of Long-lane, in the borough of Southwark, chemist, for improvements in preparing wood for the purposes of matches and fire-wood.*—[Sealed 17th April, 1849.]

This invention consists in preparing wood to be used for matches and fire-wood, by dipping it into resin oil.

The wood is first divided into pieces of the proper size for matches or fire-wood, and tied up in bundles of a suitable size; it is then immersed for about a minute in resin oil, which may be kept heated by the passage of steam or hot water through a coil of pipe at the bottom of the vessel containing the same, or it may be used cold; and, after the wood has been taken out of the resin oil, it is placed on a shelf or strainer to dry: when dry, it is ready for use.

The patentee claims, as his invention, the preparing of wood for matches and fire-wood, by immersing the same in resin oil.—[*Inrolled October,* 1849.]

To GEORGE FERGUSSON WILSON, *of Belmont, Vauxhall, in the county of Surrey, Gent., for improvements in the manufacture of candles and night-lights.*—[Sealed 14th March, 1849.]

THIS invention consists, firstly, in preparing vegetable tallow, by the processes hereafter described, for making candles and night-lights. The patentee states that vegetable tallow melts at a degree of heat somewhat above the melting point of animal tallow, and considerably below the melting point of vegetable wax,—and that it has been before employed for making candles. He does not therefore claim the same generally, but only the subjecting the same to an acid treatment or process, as hereafter described, and also causing it to be distilled in such manner that the atmosphere may be excluded from the still.

This part of the invention is carried out in the following manner:—6 tons of vegetable tallow are put into a vessel, capable of containing 9 tons, and heated gradually to 350° Fahr.; and then 1440 lbs. of sulphuric acid, of 1.8 sp. gr., are gradually added. At the expiration of about two hours, the tallow is pumped into a vessel containing water, slightly acidulated with sulphuric acid; it is agitated therein by free steam passing through it for two hours; and then the matter is allowed to repose for six hours: both this and the first-mentioned vessel should be provided with a cover and means of conveying the gases which may be evolved into a chimney. The vegetable tallow is next distilled in such manner that the atmosphere is excluded: this is best effected by the use of a vapour or product not containing oxygen; and the patentee prefers to employ highly-heated steam, which he introduces into the still and causes to divide into numerous jets or streams below the vegetable tallow; and, as the steam pervades the still, it will not only serve as the means of distilling and carrying over the greasy matter, but will also exclude the atmosphere. The distilled products are received into condensers; and they may be used alone, or they may be mixed with other matters for making the best class of candles.

The second part of the invention relates to manufacturing or treating paraffine; and it consists in subjecting it to the process of distillation with the atmosphere excluded. This may be effected in various ways; but it is preferred to employ highly heated steam in such manner that the steam at once becomes the means of distilling the substance and of excluding the atmosphere. By this means paraffine is obtained in a more pure state for making candles and night-lights; and such purified paraffine will be found useful for combining with wax and fatty and oily matters used for making candles, whether such fatty or oily matters be in an acid or other state, and whether they be distilled or not.

The third part of the invention consists in the use of vegetable tallow in the manufacture of candles with two or more wicks. Although this substance may be used in the natural state, it is preferred to be first treated with diluted acid, as above described; and it is to be mixed with the fatty or oily matters commonly used for making candles.

The fourth part of the invention relates to the manufacture of candles with two or more wicks, for lamps and other purposes; and it consists in employing vegetable wax in such manufacture as a means of giving hardness to lower melting materials.

The fifth part of the invention relates to the manufacture of candles with two or more wicks, and consists in the use, for this purpose, of fatty or oily acids combined with palm oil pressed before or after bleaching.

The object of the three last parts of this invention is to obtain candles which will give a considerable quantity of light and be suitable for burning in candle-lamps, where the candles are not seen; and may therefore be made of materials which would, in most cases, be objectionable if the same were visible when being consumed; and it is the employment of two or more wicks in a candle, with the use of the particular materials above mentioned, which constitutes the novelty of such three parts of the invention.—[*Inrolled September,* 1849.]

To Alexander Mc Dougall, *of Longsight, in the county of Lancaster, chemist, for improvements in recovering useful products from the water used in washing and in treating wool, woollen and cotton fabrics, and other substances.*—[Sealed 20th March, 1849.]

These improvements in recovering useful products from the water used in washing and treating wool, woollen and cotton fabrics, and other substances, consist in employing alkaline earths, or salts of the alkaline earths, or salts of the metallic oxides, to precipitate from their solution in water the potash and soda soaps in common use.

The mode of carrying out the invention is as follows:—A salt of an alkaline earth being added to the solution of soap, the fatty acid of the soap combines with the earthy base, and forms an insoluble compound that subsides in the solution, which now contains the alkali of the soap, in combination with the acid of the alkaline earth. The alkaline salt preferred by the patentee is muriate of lime, which is added to the soapy water so long as a precipitate is formed. After the precipitate has subsided, the supernatant liquor is decanted or drawn off by a syphon: the precipitate is thrown upon a filter of woollen cloth, to drain away part of the liquid; and the remainder of the liquid is then separated by means of the hydro-extractor, lined with woollen-cloth: the product is a soap of lime, mixed with any insoluble impurity which the soapy water may have contained. The fatty acid is separated from this product by the use of mineral acid; for which purpose muriatic acid is preferred; as, by its use, muriate of lime is obtained, to operate on a fresh portion of soapy water.

The patentee states, that he does not confine himself to the above details; nor to the use of the salt and the acid abovementioned; as others may be used, but not, as he believes, with such advantage. He claims the means, above described, of recovering useful products from the water used in washing and in treating wool, woollen and cotton fabrics, and other substances.—[*Inrolled September,* 1849.]

To William Preddy, *of Taunton, in the county of Somerset, watch-maker, for improvements in watch keys and other instruments for winding-up watches and other timekeepers.*—[Sealed 12th June, 1849.]

This invention consists in certain methods of preventing the introduction of dirt or damp into the keys used for winding-up watches, clocks, and other timekeepers.

In Plate XVIII. fig. 1, is a longitudinal section of a watch-key, constructed according to this invention. *a*, is a rod, the upper end of which works in a recess in the upper part of the key, and the lower end is formed into a square piston, which exactly fits the interior of the pipe *c*. *d*, is a helical spring, coiled around the rod *a*, and pressing against the shoulder a^1; so that when the key is not inserted in the watch, the pressure of the spring will keep the piston *b*, in its lowest position, with its end even with the end of the pipe *c*, and consequently will prevent the entrance of any damp, dirt, or dust into the pipe; but, on the key being inserted into the watch, the piston will recede into the position shewn in the drawing, and will remain in that position during the act of winding-up the watch. Fig. 2, is a longitudinal section of another watch-key, the aperture of the pipe *c*, of which is closed by a sliding piston, as in the preceding instance; but, in this case, the rod *a*, is attached to the loop or ring by which the key is suspended, and the movement of the piston is effected by pulling out or pushing in the rod *a*, by means of the ring:—a side spring *d*, is substituted for the helical spring in fig. 1. Fig. 3, exhibits another watch-key, to which a sheath *e*, is applied, for the purpose of protecting the aperture of the pipe; and this sheath is to be taken off when the key is about to be used. The same effect may be obtained by inserting a solid stopper into the pipe. Fig. 4, is a sectional view of a key for winding-up clocks; *f*, is the pipe thereof; and *g*, is a square piston, which fits the interior of the pipe, and is provided with a rod *h*, having a button *i*, on its outer end, by which the piston is pushed out or pulled in.

The patentee claims the closing of the pipes of watch-keys and other instruments for winding-up watches and other timekeepers, when out of use, by means of sliding squares or pistons, sheaths, and stoppers, as above described.—[*Inrolled December,* 1849.]

To GEORGE HINTON BOVILL, *of Abchurch-lane, in the City of London, engineer, for improvements in manufacturing wheat and other grain into meal and flour.*—[Sealed 5th June, 1849.]

THE first part of this invention consists in reversing the ordinary arrangement of the mill-stones employed for grinding wheat and other grain, by causing the lower or bed-stone to rotate instead of the upper one, which is fixed.

In Plate XVII., a vertical section of a pair of mill-stones, constructed and arranged according to this invention, is shewn. *a*, is the fixed top-stone; *b*, is the bed-stone, supported by a cast-iron dish *c*, on the driving spindle *d*; this spindle works through a deep collar, bearing in the cross stay *e*, affixed to the "hurst;" and the spindle, with the bed-stone, is raised and lowered in the usual manner. *f*, is an air-tight cover for the eye of the top stone, through which the feed-pipe *g*, is inserted. *h*, is a pipe for introducing air from a blowing machine,—the supply being regulated by the valve *i*. The lower stone is first adjusted perfectly true and level; then the top stone is laid upon it, face to face, and is secured by screws to the hurst brackets *j*, *j*; and after this the bed-stone is lowered to the exact distance required for performing the operation of grinding: the grinding surfaces being perfectly true to each other, they can never come in contact when the bed-stone has been lowered in the slightest degree; and thus the injury which results from the running-stone resting on the other and destroying the grinding surfaces, when the supply of grain is diminished or stopped, is entirely prevented. It is stated, that this arrangement will facilitate the delivery of the meal from between the stones; for the corn and meal being on the revolving stone, they will be driven outwards more rapidly than when they are rubbed outwards by the furrows of the top stone, as usual. The patentee says he is aware that it has been proposed to cause the lower stone as well as the upper stone of color mills to rotate; but this he does not claim.

The second part of this invention consists in introducing air-pipes into the fixed top stone, so as more freely to ventilate the grinding surfaces when currents of air are forced or exhausted through them. *k*, *k*, are the air-pipes, which open into the furrows on the face of the stone, and extend to the eye of the stone where the air is introduced. These pipes are preferred to be one inch in diameter, and should be as numerous as the furrows in the stone, so as to give a free ventilation in addition to the supply of air down the master lines from the eye of the stone. The patentee is aware that large holes have been cut in the runner-stone, and trumpet-mouthed pipes have been applied to the back of the runner-stone, with their ends terminating at the point of the master lines in the eye of the stone, for the purpose of introducing air between the stones; but, in these cases, the top stone has been the running stone. Air has also been exhausted downwards through the eye of the top stone, when running, and between the grinding surfaces. He does not, therefore, claim this principle, except when worked in combination with a fixed upper stone.

The third part of this invention is to be applied when the ventilation of the mill-stones is effected, by means of a blast of air; and it consists in introducing a pipe into the mill-stone case from a fan or other exhausting apparatus, so as to carry off all the warm dusty air blown through between the stones to a chamber, as hereafter described: by which means the dust in the mill is removed, and the grinding improved. This improvement relates only to sucking away the dusty air forced through between the stones, and not to employing sufficient exhausting power to cause a current of air to pass between the stones without a blast.

The fourth part of this invention consists in straining the stive or air, which is charged with fine flour, through suitable porous fabrics, which retain the flour and allow the air to pass through. This is effected by exhausting the air from the mill-stone case, or other closed chamber, that receives the meal from the stones, by means of a fan or other exhausting apparatus, and blowing the stive, so exhausted, into a chamber having its sides and top formed of one or more thicknesses of suitable porous fabrics, to allow the air, under pressure, to pass out deprived of the flour. The same result may be obtained by placing the filtering chamber between the mill-stone case, or the chamber that receives the meal, and the exhausting apparatus.

The patentee claims, Firstly,—making the bed-stone rotate instead of the top one, as heretofore practised. Secondly,—fixing the top stone and causing currents of air, either by exhaustion or pressure, to pass between the grinding surfaces of mill-stones, when the top stone is so fixed; and also the introduction of the ventilating pipes in the stones, as above described. Thirdly,—exhausting the dusty air, when the same has been blown through the grinding surfaces of the mill-stones, from the stone cases, or chambers receiving the meal, as above described. Fourthly, passing the dust or stive caused in the process of grinding, through suitable porous fabrics, by which the flour is filtered from the air, as above described.—[*Inrolled December*, 1849.]

Scientific Notices.

NEW PROCESS FOR DECOLORIZING GUM-ARABIC AND OTHER GUMS OF THAT CLASS.

Invented by M. Picciotto.

The description of this invention by the author comprises, properly speaking, an account of two inventions, or of two distinct processes, both of which have been, however, found to effect, almost equally well, the decolorization and purification of gum.

The first of these processes is founded upon the property of sulphurous acid gas, to bleach or destroy vegetable coloring matter, and may be thus described:—The first step consists in preparing a saturated solution of the sulphurous acid, by passing a current of that gas into water until absorption has altogether ceased and the water emits a strong odour of the sulphurous acid,—an odour easily recognised, as it is similar to that exhaled by burning sulphur. The solution obtained by this means must be kept in closed vessels, so that it may not be subjected to the influence of the atmosphere; the effect of which would be the conversion of a portion of the sulphurous into sulphuric acid, and the consequent material interference with the action of the former compound on the gum. Into the solution of sulphurous acid the gum is introduced, either in the state in which it is imported into Europe, or in that of powder, having been previously ground or pounded. One part, by weight, of gum ought to be added to from seven to ten parts of the solution of sulphurous acid gas. By the time the gum is dissolved, the greater part of the color will have been abstracted, or, according to the author of the process, have formed, with the sulphurous acid, colorless compounds. It is not essentially necessary, in this process, that the bleaching agent should be first dissolved in water and the gum then added to that solution;—the gas may be passed at once into a solution of gum, by which it is absorbed, and the bleaching action will be found to proceed with as much certainty as in the plan first described. The idea has been put forward by the inventor of the process, that sulphurous acid, liquified by cold and pressure, may be mixed with the mucilage; but this appears to be a modification of the invention, capable of but little practical application, as liquified sulphurous acid, although it may act powerfully as a decolorizer, is an agent of too unmanageable a character to be readily employed under such circumstances as those described.

When the bleaching is complete, it is necessary that the acid (or rather the combination of the acid with the coloring matter of the gum) should be removed from the solution. Different methods may be employed to produce this effect; but the following appears to be the most efficacious:—In the first place, the mixture is introduced into a close vessel, some kind of retort for instance, and then gradually heated during a considerable time;—the heat expels the sulphurous acid, which is merely in solution, and this may be collected in water, as at first, so that it may be employed in bleaching a second time. When the gas is completely expelled from the mucilage, the latter is poured, while hot, into an open vessel, containing a quantity of carbonate of baryta,—a substance the base of which produces, with sulphurous acid, an insoluble compound—the sulphite of baryta. Other substances may be employed in the place of carbonate of baryta, to remove the sulphurous acid; but that is preferable, inasmuch as the sulphite of baryta is equally insoluble with the sulphate of the same base,—one of the most insoluble substances known to the chemist. The combination of the baryta with the sulphurous acid in the mucilage is facilitated by agitation. When the reaction is complete, heat must be again applied, to expel the carbonic acid set at liberty in the solution during the conversion of the carbonate of baryta into sulphite; the fluid must then be left in repose for some hours, in order that the insoluble sulphite of baryta, and the solid and heavy impurities, may subside, and leave the mucilage clear and tolerably clean. Lastly, the solution must be filtered, to remove, completely, the impurities which may still float in the fluid. This filtration is recommended to be made through a thin layer of freshly precipitated alumina, or through an unglazed porous earthen vessel. A solution of gum, thus treated, may be evaporated over a water-bath, and will furnish a pure and almost colorless gum, which may indeed be rendered perfectly white by repeating the treatment with sulphurous acid. At the same time it is stated that gum, thus prepared, will have lost none of its normal properties; but is, in every respect, equal to the best gum, with the advantage of being quite colorless and free from foreign matters.

The second process for purifying gum is as follows:—One part of gum is dissolved in eight or ten parts of water, and then filtered through a cloth; it is then intimately mixed with pure hydrate of alumina, in the gelatinous state, or even with pipe-clay, or other aluminous matter; heat must next be applied to the mixture, which is then filtered, and the solution of gum will pass through the filter, almost entirely deprived of color. The filtrate of gum may be treated with alumina a second or even a third time; it will then be perfectly bleached, and a fine pure and white gum may be derived from the slow evaporation of the solution at a low temperature. It must be observed, that in evaporating these solutions to obtain the gum in the solid state, great care must be taken to prevent exposure to too great a heat, otherwise the gum will again acquire color, owing to the partial decomposition of a small quantity of its substance. The water bath is therefore the best means of evaporating such solutions, as in it the temperature can never exceed 208° or 210°.

METHOD OF PROTECTING IRON FROM THE OXIDIZING INFLUENCE OF THE ATMOSPHERE.

In the Exposition of Works of Art and Manufacture at Paris, in the present year, there were exhibited numerous articles manufactured in iron, covered with a kind of transparent vitreous coating, completely spread over the surface of the metal, like a varnish, and capable of affording a perfect protection against the action of the air, or any other oxidizing agent. This appears to be an invention susceptible of many useful applications; for, whether the iron be in the state of a rolled plate or bar, or drawn into tube; whether it be cast into water-pipes or into articles of the most elaborate form and design, as vases, and other ornamental works, it can be equally well endowed with this protective coating;—it is also a matter of indifference whether the article be made of forged or of cast-iron. The following is stated to be the process employed in imparting to the iron the vitreous surface:—Firstly, the object, whatever its shape may be, is thoroughly cleansed by dilute acid, which serves to remove, from the metallic surface, grease, dirt, and every trace of oxide;—this is important, for, if any foreign matter remain upon the surface, the perfect adherence of the fused glass will be effectually prevented, when that part of the operation is reached: after the action of the dilute acid, the work is to be well washed and then dried; when perfectly dry, it must be brushed over with a tolerably strong solution of gum-arabic, which may be applied by means of a camel-hair brush. Over the whole extent of the gummed surface, powered glass, of a peculiar kind, is then sifted; and care must be taken to cover every part of the surface with this powder, otherwise the vitreous coating will be imperfect when the operations are completed. When thus prepared, the work is introduced into a furnace or retort, heated to 100° or 150° centigrade; and, when thoroughly dry, it is removed to another furnace, where it is brought to a cherry-red heat;—the vitreous matter, which adhered to the gummed surface of the metal, now undergoes fusion: the progress of this stage of the process is ascertained by looking through a small opening (contrived for this purpose) into the heated chamber. When the fusion is complete, and the glass seems to have flowed over the whole of the surface, the article is removed from the furnace and placed in a close chamber, from which the air is entirely excluded; here it is kept until it has cooled down to the temperature of the atmosphere. The vitreous compound, applied to the surface of the metal, consists of the following substances:—

Powdered flint glass	130	parts
Carbonate of soda	20½	„
Boracic acid	12	„

These must be melted together in a "glass pot," and a fusible glass will be the result; when cold, this must be pounded with care, so that it may be reduced to a powder, sufficiently fine to pass through a silk sieve. When thus prepared, it is ready to be applied to the surface of the iron, according to the method described above. If, after the first process, the coating of vitrified matter on the metal should prove to be not quite perfect, the manipulation must be repeated,—a second coat of powdered glass being applied in the same manner as the first. It is, above all things, necessary that the vitreous matter which forms the coating should be quite free from foreign matter; for, if this be not the case, or if the surface of the object to be coated be oxidized or greasy, the coating of glass will not adhere; and the result of the operation will be, consequently, very imperfect.

It is possible, by modifying this process, not only to endow the surface of any article made of iron with a colorless vitreous varnish or glaze, but, as glasses of different colors may be used with equal ease, an effect, resembling enamel, may be produced; and, as vitreous compounds of great fusibility may also be produced by merely varying the proportions or character of their constituents, it appears probable that this process may be applicable to works in other metals besides iron.

ARSENIATE OF COPPER AS A PIGMENT.

The arseniate of copper is a substance possessing a very fine blue color, and seems worthy of occupying a high place in the list of substances employed in water-color painting; as it is permanent, of a rich and beautiful tint, and may be used under all circumstances in which water can be made the vehicle of its application. A communication on the subject of this color has been lately presented by M. Reboulleau to the "Academie des Sciences." The following is the substance of this paper:—If a mixture of equal parts of arseniate of copper and neutral arseniate of potash be heated, it will undergo fusion, and form, upon cooling, a greenish-blue mass, transparent, very fusible, and having a vitreous fracture;—this is the double arseniate of potash and copper. If, when the arseniates just mentioned are in a state of perfect fusion in a crucible, nitrate of potash (to the extent of one-fifth of the weight of the fused mixture) be projected into the fluid, in successive small quantities, there will arise a lively effervescence, with evolution of the deutoxide of nitrogen; and the crucible, when cold, will be found to contain a magnificently blue substance, consisting of the sub-arseniate of potash and the arseniate of copper, in combination with each other, and mixed with nitrate of potash. When the compound, produced as above, is treated with water, the double salt is decomposed, the arseniate and nitrate of potash are dissolved out,—the arseniate of copper, of a beautiful blue color, remaining behind. In the production of the blue arseniate of copper, it appears that the change from the green color of ordinary arseniate takes place at the moment when the nitrate of potash is added to the fused mixture in the crucible.

Is not this, therefore, an indication that the oxide of copper itself has undergone some change? The chemical action is here somewhat obscure; but it is, doubtless, one of oxidation. It is evident that the potash is not the effective agent; for, if, after adding the nitrate to the mixed arseniates, the heating be long continued after the effervescence has ceased, the compound again takes its original bluish-green color,—a change which can only here be traced to the liberation, at an increased temperature, of the oxygen which had, in the earlier stage of the process, produced the characteristic fine blue color. The question is, then, as to the existence of an oxide of copper, containing a larger proportion of oxygen than that forming the base of the ordinary green salts of that metal. Combined with arsenic acid, the superoxide seems to be stable at common temperatures, but easily reducible to a lower degree by exposure to a red heat; allowing the excess of oxygen to escape in the free state. The double arseniate of potash and copper, when placed in contact with water, is decomposed, and, as has been already shewn, the arseniate of copper may be isolated, on account of its insolubility; and, from its beautiful blue tint, it may be, no doubt, rendered extensively useful wherever water-colors can be employed.

TRANSACTIONS OF THE SOCIETY OF ARTS.

NOV. 28TH, & DEC. 5TH, 1849.

A Prize Essay by MR. J. A. LEON, *on the Cultivation and Manufacture of Sugar, was read.*

The following is an abstract thereof:—The modern agricultural improvements, irrigation and subsoil drainage, are little known in most of the British colonies; and very few of the commonest agricultural implements have been introduced there. The chief alteration which has been adopted is the planting the canes at a greater distance from each other than formerly. The theory of clearing, planting, moulding, and cutting the cane in suitable seasons, is understood, but seldom practised. It is erroneous to suppose that European laborers cannot endure the climate in the sugar-growing colonies; and European emigration ought to be encouraged. The first improvement in the West Indies should be the organization of a new system better adapted for emancipated negroes. The planter of the present day cannot do better than lease his fields to a set of negroes, on condition of their planting for him three-fourths of the land with sugar-canes; so that the negroes will be dependent for support on the produce and its quality, and will not fail to cultivate the land in a proper manner;—the owner of the estate erecting improved steam-machinery, giving up the cultivation of the land, and remaining a sugar manufacturer. The ex-planter, in his new establishment, will then no longer require hired negroes; for the people of his manufactory being British emigrants the colonial sugar will be produced by Creole growers and European manufacturers. Small West India proprietors should join their lands, so as to form a farm of 700 or 800 acres, to be cultivated as before mentioned, and erect thereon a central sugar manufactory, capable of working the produce from 500 acres of sugar-canes, which will be, on an average, 1000 tons of Muscovado sugar from 10,000 tons of canes. Thus they would farm in a small space, and manufacture with powerful machinery, in which consists the required agricultural improvements; and isolated estates might send their concentrated saccharine matter, or crude sugar, to a parochial central factory.

The cultivation of the sugar-cane requires more labor than other plants, and, in that respect, a cane-field may be compared to a garden, and, like it, requires constant care and attention.

The woody part of the ripe sugar-canes is generally consumed as fuel in the process of manufacturing sugar; other portions are used as seed, forage, and manure,—the green leaves being given as food to cattle. It is found that 100 lbs. of canes generally yield 50 lbs. of juice;—these 50 lbs. of juice produce, by the old process of manufacture, 5 lbs. of Muscovado sugar and 5 lbs. of molasses scum; the remainder, 40 lbs., is the quantity of water to be evaporated by the manufacturing process.

Nothing can surpass the slovenly, unscientific way, in which sugar is made on those estates where the common process is in use; and in the whole British dominions only four sugar-plantations have received complete steam-machinery. The author recommends steam, not only as a moving power, but also for heating and evaporating purposes, and refers to a Colonial Steam Generator, which he has invented, as answering every purpose that can be required; but this modern apparatus will be only beneficial when worked on a large scale.

In selecting the ground on which a manufactory is to be erected mainly depends its future success.

The essay then describes the various existing mills made use of in the manufacture of sugar, of which the chief defects are—1. Overspeed in motion. 2. Mismanagement in feeding. 3. Inefficiency of the moving power.

The great price of coal, however, in the West Indies, being £2. 18*s*. per ton (when used), renders the working of steam power very expensive; however, the steam may be economised and employed in subsequent processes.

The essay proceeds to describe the Steam Defecator, and other apparatus employed in the manufacture of sugar, and the advantages peculiar to each.

A great improvement in sugar manipulations, even greater than the concentration in vacuo, is the application of animal charcoal for manufacturing and refining sugar. The discovery of revivification, allowing the same carbon to be used again, enables the refiner to produce the best quality of sugar from the raw material by a single operation; and by improving on the same principle of filtration, the colonial manufacturer will succeed in producing refined sugar direct from the cane, and thereby dispense with the secondary manipulation in Europe.

Concentrated cane-juice, containing more than 50 per cent. of saccharine matter, will be altered, if boiled at a high temperature, or re-concentrated at a low one; but, if boiled in vacuo, the saccharine liquid may be rapidly concentrated at even a low temperature. The author recommends the use of Clark's Condenser—in which the steam is distributed all at once, in 216 vertical pipes, radiating to a single collecting pipe, communicating with the air-pump,—and a double-evaporation apparatus, constructed by himself, and operating—1st. Without altering the saccharine matter, as well with a minimum as a maximum of water. 2nd. Without borrowing any water. 3rd. Without requiring active superintendence, and saving fuel to a large amount.

In building a sugar manufactory, the main flue of the steam-generators should pass close to the curing-house wall before reaching the chimney,—cast-iron tubes lying across the flue, having one end in the curing-house, whilst the other receives the outside air, being heated from the caloric from the furnace, warms the inner air passing from the yard into the curing-house. Thus a hot-air apparatus is formed with great economy. The direct bleaching, *i. e.*, the artificial mode for separating the liquid from the solid sugar, is done by sprinkling water on the sugar with a small instrument made for that purpose; and, according to the number of ablutions, this operation will produce crushed lumps, or stamped loaf-sugar.

The modern steam apparatus, for manufacturing sugar with profit, requires the fulfilment of several conditions:—

During crop-time, continuous work night and day,—from whence three advantages arise:—

1st. The cane-juice does not become sour, as when left standing during the whole night in the heated apparatus.

2nd. Fuel is saved, because the fire has not to be re-lit.

3rd. Double work being done, the expenses of the machinery are reduced 50 per cent.

A better class of laborers must be procured, and work for the whole year round provided for them.

Mr. Leon is of opinion that nothing but such a total change can restore the British sugar colonies; and, to prepare for this, two things are necessary:—1st. A thorough knowledge of the modern art of building, erecting, and working the improved apparatus. 2nd. Regular theoretical and practical information on sugar manipulation for the instruction of colonial factory managers, to be given in a London laboratory, furnished with the necessary utensils for working on a small scale. The sugar for experiment should be extracted from the beetroot,—the juice of which is nearly identical with that of the sugar-cane.

The essay was accompanied with numerous drawings and models, illustrative of the apparatus and processes referred to.

TRANSACTIONS OF THE INSTITUTION OF MECHANICAL ENGINEERS, BIRMINGHAM.

OCTOBER 24TH, 1849.

Mr. Samuel read the following Paper on the Economy of Railway Transit.

THE object of the present paper is to shew that the locomotives now in use on most of the railways have outgrown the wants of the passenger traffic, and that the weight on the driving wheels of these locomotives, amounting in some cases to 14 tons, is perfectly unnecessary for the number of passengers conveyed, in 99 cases out of 100.

For the purpose of obtaining practical data upon this subject, the writer of the present paper procured a return of the number of passengers conveyed on the Eastern Counties and Norfolk Railways, both main line and branches, by each train during the week ending 7th May, 1849;—this return shewing the greatest number of passengers in each train at any one time. It appears, from this return, that the greatest number of passengers in any main line train, at any one time, was 231, and the least number 7;—the greatest number in any of the branch line trains being 82, and the least number 3; and, by another return from the books of the Company, it appears that there were conveyed on the Eastern Counties Branch Lines, during the year 1847, 42,644 tons of passengers (calculating each passenger, with his luggage, at 168 lbs.), and that the weight of engines and carriages required to convey them was about 1,112,500 tons, being in the proportion of 26 to 1.

On examining the coke returns, it also appears that the main line engines consumed from 24¼ to 40¼ lbs. per mile; and the engines for working the branch line trains consumed from 16¼ to 35½ lbs. per mile, varying, of course, with the size of the engine employed to do the work,—the smallest engines invariably consuming the smallest quantity of fuel for the same work done. The average consumption of coke during the half year ending 4th July, 1849, was 31¼ lbs. per mile for passenger engines, and 47¾ lbs. per mile for goods engines.

These returns refer to a stock of about 200 engines, and a length of line of about 310 miles.

Thus the writer came to the conclusion that it would be possible to construct a carriage and engine combined, of sufficient capacity for branch traffic; and, by his advice, the Directors of the Eastern Counties Railway gave orders to Mr. Adams to construct such a carriage, subject to the approval of Mr. Hunter, the locomotive superintendent.

The carriage was accordingly built, and called the "Enfield," from the branch which she was intended to work.

The diagram [which accompanied the paper] shews the "Enfield." The engine has 8-inch cylinders and 12-inch stroke; driving-wheels 5 feet diameter; distance between centres 20 feet; width of framing 8 feet 6 inches. The boiler is of the ordinary locomotive construction, 5 feet long by 2 feet 6 inches diameter. The fire-box is 2 feet 10½ inches by 2 feet 6 inches. There are 115 tubes of 1¼ inch diameter and 5 feet 3 inches in length, giving a total of 230 feet heating surface in the tubes. The area of the fire-box is 25 feet, giving a total heating surface of 255 ft.

The weight of this steam carriage is 15 tons 7 cwt. in working trim. The engine and carriage being combined, it is evident that the weight on the driving-wheels is increased by the load carried, and that this weight increases in the same ratio as the load required to be taken. The extreme distance between the centres of the leading and trailing-wheels being 20 feet, accounts for the steadiness of this machine: there is indeed no perceptible oscillation when travelling at the highest speed; and this verifies the observation, "that the steadiness of an engine depends not on the position of the driving-wheel, but upon the length of the rectangle covered by the wheels." This engine, at the same time, daily traverses curves of 5 or 6 chains radius.

The "Enfield" steam carriage was originally intended to convey 84 passengers, but as it was found that when she was put on as an express train the passengers increased in number, a "North Woolwich" carriage was attached, capable of conveying 116 passengers, and also a guard's brake van, making provision altogether for 150 passengers, which is now her regular train, taken at a speed of 37 miles per hour.

This engine commenced her regular work about eight months since; and the following return shews the miles run and coke consumed by the engine during the 7½ months' regular working, from January 29th to September 9th, 1849.

14,021	total miles run.		
705	hours, running time.		
1,457	ditto, standing time.		
2,162	total hours, in steam.		
743	cwt. coke consumed in running.		
408	cwt.	ditto	standing.
286	cwt.	ditto	getting up steam.
1,437	cwt. total coke consumed.		
11·48	lbs. per mile average consumption of coke.		

The "Enfield" is in steam 15 hours per day, the fire being lighted about six in the morning and drawn at ten o'clock at night. But of these 15 hours it appears, by the return, that she is engaged running only 5 hours, the remaining 10 being employed standing in the siding. It was found, by experiment, that the quantity of coke consumed standing was 32 lbs. per hour; and, after deducting this and the quantity consumed getting up steam, it will appear that the actual consumption of coke running is under 6 lbs. per mile. It must also be particularly borne in mind that this consumption of coke includes the total goods and coal traffic on the branch, amounting to 1410 tons; viz., 169 tons of goods and 1241 tons of coal.

The "Enfield" steam carriage worked the 10 a. m. passenger train from London to Ely on 14th June, a distance of 72 miles, taking behind her three of the ordinary carriages and two horse-boxes; she arrived at Ely 8 minutes before time, and the total consumption of fuel, including the getting up steam, was found to be 8¾ lbs. per mile. The tubes of the boiler are only 5 feet 3 inches in length, and the economy of fuel is consequently scarcely at the maximum. Another engine, on a similar plan, to couple with a 40-feet carriage, is now nearly ready, the tubes being 6 feet 6 inches long,—from which is expected even more economical results.

The result of the writer's experience is the conviction, that for express purposes, and for the larger portion of the branch traffic on railways, the light steam carriage is the best adapted and most economical machine, both as to first cost, compared with the work done, and in working expenses. The repairs of the permanent way are also very much reduced, as may be easily imagined.

The philosophical analysis of the question appears to be as follows:—Railways are constructed for the transit of passengers and goods; for the latter, which are capable of division into small parcels, some latitude of form and structure may be allowed; for the former, the stature and properties of man give a fixed standard. The carriage in which men are borne should be lofty enough to permit of standing upright when desired, for comfort to the rich and economy to the poor,—as a larger number may be conveyed standing than sitting in a given space. The height being settled, the *width* must be so proportioned as to exceed the height by nearly one-third, in order to induce steadiness; bearing in mind that in a railway carriage there are two bases, the "spring-base" of the frame on the axles, and the "wheel-base" of the wheels on the rails. To secure a sufficiently wide "spring-base," the axles should be projected beyond the wheels, and, in practice, a body 9 feet wide may be obtained, where the width of the railway in centre and side spaces will permit. But this width being obtained, it becomes essential to get a proportionate length to insure steadiness. Practice has verified this on the Eastern Counties

Railway, where for two years past carriages, 40 feet long and 9 feet wide, on 8 wheels (30 feet from centre to centre), have been traversing the most difficult curve and gradient in England, the radius at one part being 189 feet. The largest floor area per wheel, the minimum of dead weight compared with the load and the carriage, with least resistance to traction, is thus attained. The result of this is, that the minimum of steam power is required to draw it.

No truth is more certain than that the number of travellers by railway is increased by the facilities given for travelling. If a large engine and train costs a given sum, and the departures are every two hours, supposing that engine and train could be divided into four, and a departure take place every half hour at no increase of expense, it might be assumed that the passengers would double their numbers; but it may easily be demonstrated that the expense would be lessened, because, by improved arrangement, the total dead weight is much reduced. On the Eastern Counties Railway an engine and tender of, say, 30 tons, a break van, a first class carriage, and three third class carriages, conveying, say, 120 passengers, make a total weight of 59 tons, and the consumption of coke, as has already been shewn, is on the average 34 lbs. per mile. A steam carriage weighing only 17 tons will transport the same number of passengers at from 7 to 8 lbs. of coke per mile when the best proportions are attained. The first cost of a large engine, tender, and four carriages, has been £4000. The steam carriage for the same number can be made for something less than one-half the cost.

The value of the railroad in lessening draught consists in its perfect horizontal level, and not merely its general level, but its close approximation to the character of a lathe-bed—a hard, inflexible, smooth, true, and equable surface. With heavy engines, having 5 tons weight or more on each driving-wheel, it is impracticable to maintain any road that it is possible to construct in this condition; for supposing the timbering to be of sufficient surface, and the rails to be perfectly inflexible girders, with their joints unyielding, the very iron itself will abrade beneath the tread of so heavily loaded a driving wheel, which, whether of 8 feet or of 30 feet diameter, can only rest upon a mere point. It is a matter of doubt whether more than 3 tons can be placed on a wheel at great speeds without destroying the metal.

But there is yet another question to consider. In order to start a train into motion a great amount of power is necessary, many times greater than that which is requisite to keep up motion. This surplus power remains in the train under the name of momentum; and it must be obvious that the greater the total weight of the train the greater must be the momentum. If the road be in bad condition, with loose joints, the momentum essential to the maintaining of motion is consequently absorbed by these concussions. In short, the joints are a series of holes, and many of our railways, relatively to the heavy engines traversing them, are practically worse roads than a well-made macadamised road is to a stage coach.

If thus the weights be reduced below the point which causes destruction, it is probable that the heavy item called "maintenance of way," and the still heavier item of replacement of rails, chairs, and sleepers, will nearly disappear.

Mr. Samuel further explained the diagrams illustrating his paper, and remarked that the Fairfield steam carriage, on the Bristol and Exeter Railway, had hitherto been worked with an upright tubular boiler, which had not proved satisfactory, and the regular working of the engine had been prevented by the difficulty of keeping the tubes tight; but a horizontal boiler had been substituted, and the engine was just starting to work with it.

The Chairman (Mr. R. Stephenson) remarked, that the subject was one of great importance, and he hoped it would give rise to an interesting discussion, not leading into any unfriendly difference of opinion, but an exposition of a friendly difference.

Mr. Mc Connell said, the results given by Mr. Samuel in his paper afforded proof of great economy; but how far this description of miniature engine might be brought into use on railways in general, must be determined by actual experience to a greater extent than was yet afforded. He believed that the branch on which the Enfield engine had been running was as favorable for the trial of the engine as any that could be selected. He had himself had an opportunity of travelling on the engine from London to Enfield, when the performance was very satisfactory for the load conveyed; but any increase of load or additional amount of traffic would materially affect the performance of the engine, because, with a just appreciation of economy it had been balanced as nearly as possible to the load expected. If they could in the general management of railways ascertain the exact number of carriages required for the accommodation of the traffic, a great economy of locomotive power might be effected; but unfortunately, in practice, they were often required to provide something like a maximum of power for a minimum of traffic. He had no doubt that the circumstances of many railways, particularly in those districts where the traffic was nearly uniform, would oblige them to adopt a power more nearly corresponding to their wants and to the loads they had to take; for undoubtedly the power of many engines at present at work very far exceeded their real requirements. He agreed with Mr. Samuel that this extra weight on the rails must materially affect the question of maintaining the permanent way; and as the quantity of coke consumed while standing and getting up the steam are expenses constantly attending all engines, he thought Mr. Samuel was quite justified in taking credit for economy. He was not, however, prepared to say how far this description of engine might be made applicable; but should be very glad to see any effectual step towards economy in the expenditure of railways, and he thought Mr. Samuel deserved great credit for having made such an effort. As applicable to the subject, he recollected that on the Birmingham and Gloucester Railway it was found desirable to employ an economical power for the purposes of traffic on the small branch line from the main line to Tewkesbury, and for this purpose he adapted one of the small American engines by combining the engine and tender on one frame, and by putting a tank on the top of the boiler. But the gradients were very abrupt coming out from Tewkesbury, and when they worked the goods and passenger traffic together they were frequently obliged to increase the number of carriages, and in some cases the power was insufficient. The engine had 10½-inch cylinders, with 4-feet driving wheels, and 20-inch stroke; the consumption of coke was from 15 to 17 lbs. per mile; and the gradients varied from 1 in 300 to 1 in 80. The pressure, however, on the American engines was very fallacious, for the spring balance only indicated about one-third of the actual pressure on the boiler, which was really about 100 lbs. per inch.

Mr. Adams, of Birmingham, remarked, that the Enfield engine was all on one frame with the carriage; but a different arrangement was adopted in the Cork and Bandon engine, in which the engine and carriage were on separate frames; and he enquired the reason for adopting the former plan in the Enfield.

Mr. Samuel explained, that as the length of coupling of the engine wheels in the Enfield was only 5 feet 4 inches, with an 8-inch cylinder, it was necessary to attach the carriage and engine on one frame, otherwise it would be too short to run steadily; the effect produced by the carriage was like the stick of a rocket in steadying the motion. But in the Cork and Bandon engine, with a 9-inch cylinder, the length of coupling of the wheels was 10 feet, and no carriage was required to produce steadiness, as the rectangle on the rails was so much longer. In the case of large engines, where the distance between the axles had been increased to 16 feet, a greater steadiness was observable. There was accommodation in the carriage for 15 first class and 116 other passengers, giving a total accommodation for 131 passengers; and this he considered the most serviceable for working the express traffic. One of these steam carriages was being prepared for working on a railway in Scotland, at a contemplated speed of 40 miles an hour. At the present time it was impossible to keep the road in good repair, especially on the old lines, in consequence of the enormous weight of the engines.

Mr. Slate asked whether it was anticipated that these small engines would prove as durable, and have as long a life-time as the present large locomotives.

Mr. Samuel replied, that he expected the small engine would be as durable for locomotive purposes, and even more so than an engine of larger dimensions; the bearings could be made larger in proportion to the strain, and the boiler, being smaller in diameter, the steam could be compressed with greater safety. The Enfield engine was worked at 120 lbs. pressure, while in ordinary engines it did not exceed 80, and hence an advantage of 40 lbs. was obtained. The heating surface of the fire-box was 25 feet.

Mr. McConnell said, they had a great number of small engines originally on the line, but they were not able to take the traffic. His experience was, that in a long run the small engines exhausted themselves, and were not able to keep up their steam if they had anything like a load.

Mr. Samuel said he had, with the Enfield engine, made the quickest journey that had ever been performed between Norwich and London. With a train capable of containing 84 passengers they performed the distance of 126 miles in 3 hours 35 minutes, including stoppages. Another advantage in a large carriage of this description resulted from making use of the side space,—for there were only 8 wheels to do the work of 24, and at the same time they had no greater amount of weight on each wheel than under the ordinary arrangement. The whole weight was 9 tons without passengers, and 84 passengers might be taken at an average as weighing 6 tons.

Mr. Mc Connell said, that undoubtedly with the present carriages the proportion of the tare to the passengers carried was very great; and, although a case which rarely happened, instances had occurred were the tare was 50 tons to 3 tons of passengers. But even, taking the weight of passengers at 10 tons, 50 tons of carriages was unquestionably a large proportion of dead weight to carry; and he considered that the long carriage, if always likely to be well employed, would be an advantageous mode of saving the dead weight, more especially on branch lines, and at the junctions where such branches came in.

The Chairman said, they were much indebted to Mr. Samuel for bringing the subject before them; and he only wished that more of their railway friends had attended the meeting, for it was a paper which well merited their deep consideration in the present depressed state of railway interests. The question of economy in the heavy current expenses of railways had for some time occupied his attention; and although he did not go to the full extent with the proposer of this new system, he nevertheless went to a considerable extent with him, and admitted that there were cases of passenger traffic, and branch traffic, and sometimes even short local lines, such as that from London to Greenwich, London to Blackwall, or London to Broxbourne, where the number of short passengers was great, and the number left in long trains was very small, thus causing the train, after a certain portion of the journey, to work very disadvantageously. He had no doubt that companies would have to classify these trains to a much greater extent than had hitherto been done, and in that case the present plan might be tried with advantage; but he could not go with Mr. Samuel in saying that an engine so light as he had described was applicable to express travelling. Even the principle of attaching a carriage to the engine for the purpose of giving adhesion, appeared to him a very doubtful expedient, because small engines were much heavier in proportion to their power than large ones. He considered that Mr. Samuel's arrangement in the case of the Cork and Bandon engine was a good one, but attaching a carriage to an engine was very objectionable; it was like riveting harness to a horse, and could not be desirable under any circumstances whatever. Mr. Samuel did so to increase the weight on his driving wheels, and consequently obtain more adhesion; but he forgot that he had already more weight on the driving wheels than was adequate to drag the carriage along. This was adding more than enough,—because an engine that weighs only 5 tons is not so capable of slipping upon the rail as an engine that weighs 30 tons; and therefore attaching a carriage upon the frame of a small engine was superfluous, and the inconvenience arising from having them riveted together would in some cases be exceedingly great, more especially in working a station. Cases however might presently arise which would be favorable to the development of the proposed system; for instance, railways had been laid down where hardly any justification existed for their construction; these must be worked at the least possible cost, and Mr. Samuel's plan might be adopted advantageously; but let not his very useful system be overstrained, because there was no great branch line, express or otherwise, to which it could by possibility be applicable. It would be largely applicable to minor branch lines, but he (the chairman) felt that if he were to allow this paper to be read without saying anything—considering the position which he occupied in the railway world, it would be taken as a tacit acquiescence on his part in the broad principle of applying small engines where in fact for a period of nearly 20 years (ever since 1831) they had been doing everything in an opposite direction to that which Mr. Samuel was now pursuing. Hitherto they had been contriving engines to develope railway traffic on the main trunk lines, where not only great dispatch, but great comfort, is exacted; and he would ask whether the public would be satisfied to be packed up like fish, ninety in a carriage. That they would not be content with inferior accommodation was sufficiently evident from the eagerness with which on the arrival at a station persons made their way to the four inside carriages, which he thought were much more conducive to comfort than the broad gauge carriages with eight inside.

Mr. Samuel remarked, that in his carriages he thought there would be more and better accommodation than afforded by the present system, as not only were they 9 feet wide, but high enough for the tallest passengers to stand upright if they felt disposed.

The Chairman did not think that the loftiness of the carriage removed the objection, because it was quite possible for a crowd to be very closely packed.

Mr. Samuel replied, that he allowed the same floor area for each passenger as in the present system.

The following paper, by Mr. Mc Connell of Wolverton, was then read.

On Railway Axles.

When the railway system was first introduced into this country, the question of the strength of the materials for constructing the new stock was (it is to be presumed) materially influenced by the amount of experience derived from the vehicles which had previously been in use for the conveyance of traffic. As the new system became extended and improved in all its arrangements, and the facilities which it possessed for conveying greater loads at higher speeds were gradually developed, the working stock was necessarily changed from time to time in conformity with the greater demands for convenience and stability. Improvements in almost every point have been carried out until we have now the railway stock, generally speaking, in an excellent condition for the purpose to which it is applied.

It is remarkable that, notwithstanding the importance of proportion and quality as first elements in considering the strength of the materials of which railway moving stock is composed, no rule, generally applicable for even the main features of this great system of machinery, has been established. Without attempting to embrace the whole subject, although one of great importance to proprietors of railways and the public generally, I conceive it is proper in this place to express my strong conviction that the general question of the strength and quality of those materials justly proportioned to the strains to which they are subject, and bearing reference to accidents from collision, faults of road, deterioration from a variety of causes, &c., must eventually be treated with great attention and consideration; and in order to insure safety to life and property for all who use railways, as well as the greatest possible economy for the profit of those who have embarked their capital in their construction, I believe it will be found essential to have some regulations founded upon the joint experience of those parties who have been practically engaged in managing and working the different departments of railways.

It is well known that short-sighted economy has been practised in many instances in giving directions for the purchase and repair of railway stock, and it is only dear-bought experience which can effectually convince those parties who, to make a little saving by purchasing a cheap ill-constructed machine, gain a great and constant loss whilst it is in use.

The advantages of a general and constant interchange of opinion among those parties to whose judgment and management the working expenses of the different railways are entrusted, is most important; and if such varied experience could be collected regularly and systematically into one focus, where it might be digested and prepared for practical use, the effect for good to the general system of railways would be very great, and, in a scientific point of view, the results recorded would prove highly interesting.

Having thus briefly stated a portion of my views as bearing upon the introduction of the best means of producing uniformity in the working stock of railways, I will now proceed to consider "Railway Axles," which, as an important part of the great machinery, are deserving of marked attention.

I have endeavoured to ascertain whether any data were available which might assist me in forming a groundwork of the results of combined experience on this subject; but I regret to say that, although my inquiries have been in all cases promptly and carefully attended to, yet the object which I had in view has not been attained. As an example of the diversity of opinion, or rather perhaps the want of some certain rule to guide engineers in proportioning the strength of axles to their weights and strains, I would refer to the different forms of axles now in use on one portion of one railway; and, in doing so, would remark, that a clearer proof could not be afforded of the desirableness of some defined principle to guide us in deciding on the strength for railway axles.

For obvious reasons I wish particularly to guard against expressing, directly or by inference, any opinion on any description of manufacture of axle, or even quality of iron of which axles are composed. I would wish to limit the scope of the present paper simply to the question of the form and dimensions of axles, with the changes and deterioration to which they are subject in process of working; assuming in all cases the material of which the axles are made, and the mode of manufacture, to be of the most approved description.

In order to arrive at a knowledge of the best form and dimensions of axles, we have first to ascertain the load and friction to which they are to be exposed; and, secondly, to estimate as nearly as possible the strains to which they will be subject whilst in motion. Supposing a waggon or carriage to be constantly in a state of rest, it would of course then only be necessary to consider the axle as a beam or girder, sustaining a load of 5 tons upon the two journals,—the points of support being the wheels resting upon the rails;—the middle portion of the axle being of sufficient strength to sustain the wheel or prop in its perpendicular position. We then require to find out the proportionate strength, so that each section of this beam or girder shall only be sufficiently strong to resist the strain or load to which it is then subject. It is ascertained, by an approximate calculation, that a journal 1.128 inch diameter, is not capable of sustaining a heavier load when in a state of rest than 2½ tons, or 5600 lbs.; and allowing in practice that the waggon or carriage axle is made ten times the breaking strength, the diameter of the journal would be, adopting the same calculation, 2.43 inches. In these calculations the strength alone is considered, but we have also to take into account the question of friction and likewise the tendency to abrasion.

With our present means of information, no accurate data are available for determining the best proportion of journal or bearing according to the weight it has to bear, or the velocity at which it is required to move. A great variety of proportion is in use; but it is fair to note that in engine axles particularly, the length of bearings depends to a certain extent upon the construction and arrangement of the engine: as a general rule the length of the bearing is not in due proportion, according to our general experience, to the diameter. It has always been considered that having first ascertained, from example and experience, the strength of sectional area necessary under every circumstance to sustain the load which the journal has to carry, the length of it was determined by the velocity or amount of friction to which it is liable. Judging from axles at present in use in carriages and waggons, the length of bearing is twice the diameter of the journal; but on this, as well as other points on strength of material, there exists a great variety of opinion. Even the forms of journals are found to differ very much. Without attempting to decide on the merits of any of them, I shall in the present instance content myself with stating, that all my experience has proved the desirableness of maintaining the rubbing or wearing surfaces of bearings as free as possible from sharp abrupt corners, and sudden alterations in diameter or sectional strength.

Having thus treated the journals as regards the load and friction upon them, I now proceed to estimate the various strains to which the axle is exposed whilst in motion.

The first strain to which the axle is subject is that arising from the weight of the waggon and load, which, being received or resting on the journal, produces the greatest effect upon the axle at the outer face of the wheel-boss; and to which is to be added the momentum of the load in falling through the spaces caused by inequalities in the joints of the rails.

The injurious consequences upon the axle of inequalities of the road surface, and flat places on the surface of the wheel-tyre, by the jolting or perpendicular motion which they produce, cannot be accurately estimated, and these are very much increased when the bearing springs of the waggon or carriage are not sufficiently elastic, and do not yield to the shock or blow downwards, so as (to use the expression) to cushion its effect. As an instance of the imperfect action of the springs, I would allude to those in use on many waggons, in which the form and construction cause them to be so rigid that the downward blow is more like a hammer upon an anvil. To obviate this strain as much as possible, it is necessary to proportion the spring so as to sustain the load properly, and yet to be of sufficient elasticity to absorb the effect of the load oscillation.

The strain arising from the oscillation of the waggon on curves from imperfect coupling, and increased by the lateral freedom or space on the bearings or play between the rails and flanges of the wheels (which when an irregularity occurs on the side of the rail, or any sudden cause disturbs the direct motion of the waggon onwards), is in effect the same as a blow upon the flange of the wheel,—the radius of the wheel tending to act as a lever to break the axle at the inner face of the boss of the wheel. This strain is in the compound ratio of the momentum of the load; the angle at which the wheel strikes the rail, and the distance from the centre of the axle to the point of impact, producing an effective strain upon the axle at the inner face of the wheel-boss, which extends proportionately over the whole axle between the wheels.

To lessen in practice, as much as possible, the deteriorating effect of these descriptions of strains upon the axle, the following conditions are important:—That the bearings or journals of the axles fit as closely to the brasses as is consistent with freedom, the allowance of flange-gauge of wheel being quite sufficient for the carriage to move freely round curves and meet any irregularity in the gauge of the rails. That the waggons or carriages be as equally loaded as possible, and the draw-chains be exactly in the centre; and as side-chains are dangerous they should be completely removed,—provision being made for a duplicate centre draw-chain should a failure take place. As the damage to the loading of waggons is in proportion to the oscillation, they should all be screwed together by means of screw-couplings, having spring-buffers upon both ends of every waggon. It is well known that the injury to the waggon, to the load which it conveys, to the axle which carries it, and to the road over which it runs, is very much aggravated if the waggons are allowed to oscillate from side to side, and become like so many battering rams, injuring themselves and all substances in contact with them. A train of waggons or carriages should be jointed together similar to the vertebræ of an animal, by which means any sudden lateral action would be neutralised by the support derived from the neighbouring vehicles. The road to be kept as accurate as possible to gauge and line.

The third class of strains to which axles are liable, are the shocks produced by starting and stopping a train, and which are in proportion to the momentum of the wheel and axle at the time of collision when stopping, and to the velocity of the impelling force and the inertia of the wheel and axle when starting: these strains are felt principally on the neck of the journal.

Fourth strain—the torsion or twisting caused by the wheels travelling over curves of the line: the difference in length of surface of the inner and outer rail compels one wheel to grind or slide upon the rail, while the other is free to roll. This strain is proportionate to the load on the wheel, determining the amount of friction upon the rails and the length of axle between the wheels. A slight amount of torsion is also caused by any variation in the diameter of the wheels on the same axle, by any inequality upon each journal, the quality of the brasses, or the amount of lubrication proportionately, and the strain of the break-block on one side; because when any of these occur separately or jointly, one-half of the extra strain on one journal is transmitted through the axle to the other, and a twisting or weakening of the axle is necessarily produced. To lessen the amount of the above strain, it is obvious that the wheels should be kept in the best possible state of repair, so far as equal diameters and true circular surfaces are concerned: the waggons or carriages should be loaded equally on each side, the journals carefully lubricated, and all break-blocks adjusted to bear the same pressure on both wheels of the same axle.

Fifth strain—the constant vibration of the whole axle. This is more particularly the case and is accelerated when the axle is fixed in a rigid unyielding wheel. My experience has proved that the axles fixed in cast-iron wheels are very much more liable to deterioration than those in wrought-iron wheels, and the jar or vibration tending to deteriorate the quality of the iron, by altering its texture from fibrous to crystalline, is clearly visible in its effects in several fractures which I have seen. It would appear that the cast-iron wheel acted more like a hammer on the axle, and, as in the cold-swaging process, a gradual breaking up of the fibre at the back of the wheel goes on, which is shewn by an annular space, varying from ⅜ inch to ¾ inch in breadth: the strength is completely destroyed of this outer portion, and a sudden shock of the wheel upon some point of the road completes the fracture of the axle.

Among other causes which contribute to the deterioration of axles, may be mentioned the practice of throwing cold water on the axle to cool it, which has become nearly red hot from the want of proper lucubration of the journal.

With regard to the strain to which the portion of the axle between the wheels is subject, there can be no doubt if the form of the axle is so proportioned, that any blow transmitted through the wheel is received equally along the whole body of the axle, and the sectional strength at each point is fairly balanced to resist the effect of the blow,—the axle will then be best suited to prevent deterioration at any particular place.

With the view of determining the weakest point of a common waggon axle under different circumstances, I made a few experiments, as follows:—In the first experiment the power was applied to the flange of the wheel, and the resistance (as in the case of a railway axle when running) at the centre of the opposite wheel: the result was, that the axle began to bend from a straight line at 12¼ inches distance from the boss of that wheel to which the power was applied: and there is no doubt that if the power had been continued, the fracture would have taken place within the 12¼ inches.

As a proof of this, in the second experiment, an axle of precisely the same dimensions and form, on being bent alternately backwards and forwards (the power being always applied on the same wheel at opposite points) was broken at the twelfth time of bending, within 6 inches of the back of the wheel.

In the third experiment the power and resistance were exactly in a parallel line to the centre of the axle, and the result, as might be expected, was a curve of a nearly uniform radius; proving that although the form of this axle was adapted to receive the blows of both wheels at precisely the same instant, and to the same extent (an impossible circumstance in practice), it was not suited to receive alternate strains or shocks, to which all axles are subject in ordinary use.

The sizes of the axles in the above three experiments were precisely alike.

In the fourth experiment another axle of the same dimensions was taken, and reduced at the centre in a lathe to the following dimensions:—The axle was divided into eight equal spaces from the back of the wheel to the centre of the axle. Immediately at the back of the wheel the axle was 4 inches diameter, and the deflection was 9½ inches; at the first space the diameter was 3⅜ inches, and the deflection was 8⅜ inches; at the second space the diameter $3\frac{3}{16}$ inches, and deflection 7 inches; at the third space the diameter $3\frac{1}{16}$ inches, and deflection 5⅝ inches; at the fourth space the diameter $2\frac{15}{16}$ inches, and deflection 4¼ inches. Up to this point the axle maintained a straight form from the back of the wheel; and from this point to the centre of the axle, as shewn by the deflections, it assumed a fair curve; proving that the axle was weaker towards the centre than it ought to have been, and that the first 12 or 14 inches from the wheel, having maintained the straight form, was stronger in proportion.

In the fifth experiment the axle was reduced to two inches and a half in the centre, and, with the power applied, as in the last case, the weakness at the centre was more perceptible.

In the sixth experiment the axle was made of another form, weaker immediately at the back of the wheel and at the centre.

We had here two bends or curves, with a straight portion between them.

In the seventh, there was an improvement upon the sixth, but it did not realise a perfect balance of strength at the different points.

In the eighth experiment this was fairly accomplished, the proportion being as follows:—From the back of the wheel to the centre of the axle the sizes were $4\frac{1}{16}$ diameter, $3\frac{1}{4}$ diameter, 3 inches diameter, $2\frac{7}{8}$ diameter, $2\frac{13}{16}$ diameter, $2\frac{3}{4}$ diameter, $2\frac{11}{16}$ diameter, $2\frac{5}{8}$ diameter;—the half-length of the axle being divided as before into eight equal spaces.

It must be evident that this can only be an approximate result, but we found that these proportions enabled us to attain the nearest approach to a regular curve in bending the axle; and it is worthy of notice that when the dimensions of the axle at the journal and in the boss of the wheel are determined, a calculation to ascertain the exact proportion between the wheels seems to confirm the above statement of dimensions in the eighth experiment. The greatest strain to which this portion of the axle is subject, being received at the bottom flange of the wheel, and transmitted through its radius, the amount of strain which any portion of the axle has to resist is inversely as its angular distance from the point of impact is to the radius of the wheel. Assuming the blow on the flange of the wheel to exert a breaking force equal to 102,229 lbs., and the diameter of the axle to be 4.71 inches to resist this blow, then, dividing the axle into four equal spaces to the centre, the proportionate breaking force at each point would be as follows:—At the first, 94,381 lbs., relative diameter, 4.59 inches; at the second, 80,697 lbs., relative diameter, 4.35 inches; at the third, 67,798 lbs., relative diameter, 4.11 inches; at the fourth, 58,899 lbs., relative diameter, 3.92 inches.

With regard to engine axles these proportions will apply where no circumstances exist of employing the centre of the axle for transmission of power. The crank axles of locomotive engines cannot be treated by any of the rules applicable to straight axles; and our experience would seem to prove that, even with the greatest care in manufacturing, these axles are subject to a rapid deterioration, owing to the vibration and jar which operates with increased severity, on account of their peculiar form. So certain and regular is the fracture at the corner of the crank from this cause, that we can almost predict in some classes of engines the number of miles that can be run before signs of fracture are visible; a certain amount of injury can be prevented by putting counterbalance weights opposite to each crank, which lessens the vibration very considerably.

It is right to observe in this place, that to some extent the injury to all axles may be increased, if the wheels in which they are fixed are not properly balanced; and I have no doubt that a great portion of the constant vibration to which they are subject may be traced to the knocking action of the wheel upon the rail, owing to a want of balance.

The question of deterioration of axles arising from the various causes, which I have enumerated, is a very important one to all railway companies; that some change in the nature of the iron does take place is a well-established fact, and the investigation of this is most deserving of careful attention. I believe it will be found that the change from the fibrous to the crystalline character is dependent upon a variety of circumstances. I have collected a few specimens of fractured axles from different points, which clearly establish the view I have stated. It is impossible to embrace in the present paper an exposition of all the facts on this branch of the subject; but so valuable is the clear understanding of the nature of the deterioration of axles, that I am now registering each axle as it goes from the workshops, and will endeavour to have such returns of their performances and appearances at different periods as will enable me to judge respecting their treatment. When it is considered that on the railways of Great Britain there are about 200,000 axles employed, the advantage of having the best proportions, the best qualities, and the best treatment for such an important and vital element of the rolling stock, must be universally acknowledged.

The Chairman observed, that as there were many members present well versed in the qualities of iron, he hoped to have some observations from them tending to confirm or to call in question the positions taken by Mr. Mc Connell in his paper.

Mr. Henderson thought the subject was a very important one, and had been well treated in Mr. Mc Connell's paper; and he hoped the investigation would be carried out by further experiments.

The Chairman said, that Mr. Mc Connell had expressed a strong opinion, that a change took place from a fibrous structure in iron to a crystalline one during the time of its being in use; and it would be satisfactory if an instance could be pointed out where this change had occurred, owing to vibration or any other treatment, for he had not been able to satisfy himself from many experiments that any such molecular change took place. Hammering a piece of hot iron till it is cold produced a hardness called crystalline; but the question for consideration was, supposing an iron axle were annealed by heating to a dull red heat and being allowed to cool slowly, would the "texture" of that iron undergo any alteration afterwards from the vibration of the railway or any piece of machinery they were in the habit of employing. He had not been able to detect an instance of the kind; and in giving evidence before the Iron Girder Bridge Commission, he mentioned cases of vibration going on from year to year without any sensible change occurring in wrought or cast-iron. For instance, they had the Cornish engine beam with a strain of 50 lbs. per inch, working 8 or 10 strokes per minute for more than 20 years; and certainly, if a molecular change was introduced by vibration, it ought to be by that continual concussion and vibration, but none was perceived. Again, the connecting rod of a locomotive was a piece of iron in a most perplexing situation,—for one having more to do and having the strain changed more frequently it was difficult to conceive; and yet he had known the connecting rod of a locomotive engine to vibrate 8 times in a second for several years' regular work, making more than 200 million times altogether; but the iron retained its fibrous structure; and he thought axles could not be subject to so much vibration. When, therefore, he found that a connecting rod did not change its molecular texture, he must say there were good grounds for doubting that iron changes its state in axles. Then with regard to the experiments made by Mr. McConnell with a view to ascertain where axles were most exposed to tension, he could not quite agree with him, for he subjected the wheels and axles to a slow steadily increasing pressure, till he bent the axles in different positions. The results were correct as far as regarded the slow pressure on the flanches of the wheel under the circumstances of the experiments recorded by him, but they were not a faithful representation of what takes place in practice; for it would be found that when the wheels of a carriage jarred, a violent blow was inflicted on the rail, and the strain on the axle was totally distinct from a slow pressure. He would refer to the experiments made some years ago by Mr. John Gray, on the Hull and Selby Railway, and which were published in the Engineers' and Architects' Journal, or the Mechanics' Magazine, to shew how important is the element of time in the fracture of an axle. He took a round bar of iron 3 feet long and 2 inches diameter, and turned it down in the middle, to 1 inch in diameter for 2 inches in length. He then took another bar 1 inch in diameter uniformly throughout, and he tried the strength of these bars under *concussion*, and not mere pressure. Now the severest point of strain would evidently be the middle of the bars where the diameter was the same in both, and consequently, if weights were gradually and quietly laid on, the results would be alike in both bars; but when small weights were let fall on them, the bar 1 inch in diameter throughout its whole length was found to be much stronger than that which was in the main 2 inches and 1 in the middle. For as time is an element when the resistance of material is concerned, regarding the axle as elastic like a piece of India-rubber, the only particles that could yield to percussion from the falling weight were those between the shoulders in the part of the axle that was turned down; but in the case of the bar an inch in diameter throughout its whole length the whole of the particles would yield;—the one being a good spring and the other a very bad one. It therefore appeared to him that the experiments recorded by Mr. Mc Connell, though correct as regarded the position in which he put them, were not correct as regarded concussion. The axles rarely if ever broke in the middle, but generally at the end close to the boss of the wheel; because of the sudden change in the elasticity of the axle at that point; the portion of the axle fixed within the boss of the wheel being very rigid, whilst the rest remained elastic, which caused the vibrations to be suddenly checked at that point. No doubt the plan of weakening axles in the middle had done good, because it made them spring, and in crank axles it relieved the strain in the cranked part.

Mr. Henry Smith suggested that in the case of bar-iron, the exterior portion had greater tenacity than the interior or under part; and the strength would be more than proportionately diminished where the exterior portion was cut through. He also referred to some experiments in which he had cold-hammered fibrous iron till it became crystalline, and the effect produced corresponded with the description given by Mr. Mc Connell of the fractured axles.

Mr. Mc Connell observed, that he had met with several cases of broken axles in which a distinct annular space was observable all round the surface of fracture, that was quite short-grained and appeared changed into a crystalline texture, whilst the centre of the axle remained fibrous. He admitted that his experiments were only approximative, and that he had not put the strain in the natural way; but it was almost impossible to do so in consequence of the great trouble and expense that would have accompanied it; at the same time the results were proportionate in each case, and the accuracy of the experimental results had been confirmed by calculation. With regard to the axle fitting into the wheel, they now allowed only a very small shoulder, not exceeding a sixteenth of an inch, and this shoulder was not square but tapered, and the boss of the wheel was slightly coned to fit the shoulder.

Mr. Cowper did not believe that any axle which, when broken, proved to be crystalline, had ever been fibrous in its character.

Mr. Ramsbottom considered that a change took place in the axle from the effect of mere mechanical action, and his observations had tended to confirm him in that opinion. Some time ago he selected an axle which had not a very good form of journal, and the end broke off with two blows of a 12 lb. hammer. This axle had for three years been subject to a strain vertically, which was reversed at every revolution, and it came off with a crystalline fracture. He then tried the part that had been within the boss of the wheel, which had not been subject to this great strain, and found the strength was very much greater than that of the journal, for it required 79 blows to break it off, and in that case the fracture was fibrous. A parallel case might be observed with reference to an ash stick, which, if doubled, would break with a fibrous fracture; but if subjected to vibration, however slight, running through it a great number of times, it would break in a different mode. He thought the strain on a locomotive connecting rod was by no means so great for the sectional area as upon an axle journal; and the latter had two reversed strains for every revolution of the small wheels, but the connecting rod had only two for each revolution of the driving wheels.

The Chairman said, he was only desirous to put the members on their guard against being satisfied with less than incontestible evidence as to a molecular change in iron, for the subject was one of serious importance, and the breaking of an axle had on one occasion rendered it questionable whether or not the engineer and superintendant would have had a verdict of manslaughter returned against them. The investigation hence required the greatest caution; and in the present case there was not evidence to shew that the axle was fibrous beforehand, but crystalline when it broke. He therefore wished the members of the Institution, connected as they were with the manufacture of iron, to pause before they arrived at the conclusion that iron is a substance liable to crystallize, or to a molecular change, from vibration. For his own part, he was now induced to look upon wrought-iron as literally elastic, like a piece of India-rubber; for in the case of the Britannia Tubular Bridge, where they had two 10-inch square chains or bars, each 100 feet in length, it was found that before the tube was raised, the chains or bars stretched nearly 2 inches in length at each time of lifting, but resumed their original length when the strain was withdrawn; the same action being repeated every time the tube was lifted. He could therefore only regard these 10-inch bars of iron as analogous to a piece of India-rubber.

Mr. Mc Connell said, he had one specimen of an axle which he thought furnished nearly incontestible evidence of the truth of his position, that a change took place in the texture of the iron. One portion of this axle was clearly fibrous iron, but the other end broke off as short as glass. The axle was taken and hammered under a steam hammer, then heated again and allowed to cool; after which, they had to cut it nearly half through and to hammer it a long time before they could break it.

The Chairman remarked, that this was a case of converse reasoning; for it was an instance of a piece of crystalline iron being converted into fibrous iron. Iron when it was once heated and allowed to cool gradually, acquired a close and fine grain, but became neither crystalline nor fibrous; if cooled suddenly, it acquired a crystalline grain, and if rolled while being cooled, it became fibrous; but he did not think that it underwent any molecular change from mechanical action after it was cold.

Mr. Henry Smith observed, that throwing cold water upon hot journals did great injury by crystallizing that portion of the axle.

Mr. Slate did not think that any change from a fibrous to a crystalline texture was produced in iron unless it were strained beyond the limit of its elasticity. Some of the pump rods in Staffordshire which had been in use for 18 or 20 years, were subject to a strain of 3½ tons per square inch; and a short time ago he had occasion to ascertain their actual performance with reference to this very question,—and this not being considered conclusive, he had made a machine in which he put an inch square bar subjected to a constant strain of 5 tons, and an additional varying strain of 2½ tons, alternately raised and lowered by an excentric 80 or 90 times per minute; and this motion was continued for so long a time that he considered it equal to the effect of 90 years' railway working,—but no change whatever was perceptible; and therefore he was one of those who did not believe in a change from a fibrous to a crystalline structure in iron. He remembered a case where a question having arisen as to the manufacturers of a certain shaft, it was agreed to hammer it until it split, as a means of discovering the nature of the manufacture of the shaft: the result was satisfactory; and the iron appeared still fibrous in texture.

LIST OF REGISTRATIONS EFFECTED UNDER THE ACT FOR PROTECTING NEW AND ORIGINAL DESIGNS FOR ARTICLES OF UTILITY.

1849.

Nov. 28. *Francis Klamm*, of 95, York-street, Commercial-road East, for an improved rotary heel-tip.

29. *William Murray*, of University-street, London, for a compensating ball-lever.

Dec. 1. *William Broughton*, of South-street, Finsbury-market, stove and grate manufacturer, for the "*ne plus ultra* stove."

3. *Richard Bell*, of 16, Basing-lane, for a metallic fusee-box.

4. *Thomas Curry*, of St. Phillip's Marsh, in the parish of St. Phillip's and Jacob, in the City of Bristol, boiler-maker, for improvements in the shape, configuration, and arrangement of a steam-boiler.

4. *John Cocker*, of 12, Cheapside, Bolton, Lancashire, for an improved brush.

4. *Samuel Whitfield*, of Birmingham, for a window-cornice and cornice-pole.

5. *George Chance & John Bird*, of Kingswinford, for a furnace-grate.

7. *John Smith*, of Uxbridge, Middlesex, iron-founder, for the "Royal Albert cultivator."

7. *Henry & John Gardner*, of 453, Strand, lamp manufacturers, for the "improved magic stove."

7. *William Woodward*, of the Minories, London, for a concave whelp, for ships, windlasses, and capstans.

Dec. 8. ***Thomas Kitson Potter***, of Huddersfield, for the "Victoria spirit lamp."

8. ***Edmund Wallace Elmslie***, of 67, Gloucester-road, Hyde-park, architect, for an improved ventilating sash-bar, adapted to all kinds of windows.

8. ***Battersby, Telford, & Co.***, of Waterloo Foundry, Liverpool, for an improved self-revolving sheave.

10. ***John Grant***, of Hyde-park-street, for the "cottager's stove."

10. ***Mary Harvey***, of Cornhill, Dorchester, in the county of Dorset, ironmonger, for the "Neapolitan stove."

10. ***John Sheringham***, of Kensington, for a ventilator.

10. ***James Keithley***, of Bradford, Yorkshire, for a Tee-shaped boiler for heating buildings, &c.

11. ***Thomas Moxon***, of High-street, Leicester, woollen draper, for a cheese-bandage.

13. ***John Ambrose Coffey***, of 19, Sydney-street, Commercial-road East, Middlesex, coppersmith, &c., for improved chemical apparatus.

14. ***William Wilson***, of Wandsworth-common, for a beetle-trap.

15. ***Thomas Key***, of Charing-cross, London, musical instrument maker, for a double-keyed-slide trombome.

15. ***John Remington***, of 11, Shaftsbury-crescent, Pimlico, engineer, for the "balcony fire-escape."

18. ***Isaac Whitesmith***, of Rose-street, Glasgow, machinist, for a spindle and flyer.

18. ***George Rush***, of Elsenham Hall, Essex, for dials for the improved aneroid barometer.

19. ***George Clark Rout***, of 19, High-street, Portsmouth, naval and military tailor, &c., for riding trousers.

19. ***John Mayes***, of 19, St. John-square, Clerkenwell, for an improved razor-strop.

19. ***Joseph Dawson***, of Islington-green, for a cravat or handkerchief for the neck.

22. ***Bathgate & Wilson***, of Canning Foundry, Liverpool, for a metallic cask or vessel.

27. ***John Meik***, of Sunderland, civil engineer, and ***Henry Watson***, of Newcastle-on-Tyne, brass-founder, for a signal-house.

28. ***Augustus Smith***, of 8 and 9, Osborn-street, Whitechapel, brush manufacturer, for the "universal painter's brush."

28. ***Westley Richards***, of Birmingham, for a cork-screw.

28. ***William Gordon***, of the Army and Navy Club, St. James's-square, London, Lieutenant R. N., for a pair of marine steam-engines.

List of Patents

That have passed the Great Seal of IRELAND, from the 17th November to the 17th December, 1849, inclusive.

To Henry Knight, of Birmingham, in the county of Warwick, mechanical engineer, for certain improvements in apparatus for printing, embossing, pressing, and perforating.—Sealed 21st November.

Pierre Armand le Comte de Fontainemoreau, of No. 4, South-street, Finsbury, for certain improvements in weaving,—being a foreign communication.—Sealed 22nd November.

Alfred Barlow, of Friday-street, in the City of London, warehouseman, for certain improvements in weaving.—Sealed 24th November.

Sir John Mac Neill, Knight, of Dublin, and Thomas Barry, of Lyons, near Dublin, mechanic, for improvements in locomotive engines, and in the construction of railways.—Sealed 26th November.

John Combe, of Leeds, in the county of York, civil engineer, for improvements in machinery for heckling, carding, winding, dressing, and weaving flax, cotton, silk, and other fibrous substances.—Sealed 26th November.

Charles Cowper, of Southampton Buildings, in the county of Middlesex, patent agent, for certain improvements in the manufacture of sugar,—being a foreign communication. Sealed 4th December.

Conrad William Finzel, of the city and county of Bristol, sugar refiner, for improvements in the processes and machinery employed in, and applicable to, the manufacture of sugar.—Sealed 4th December.

George Simpson, of Buchanan-street, in the City of Glasgow, North Britain, civil and mining engineer, for improvements in the machinery, apparatus, or means of raising, lowering, supporting, moving, or transporting heavy bodies.—Sealed 11th December.

William Buckwell, of the Artificial Granite Works, Battersea, in the county of Surrey, civil engineer, for improvements in compressing or solidifying fuel.—Sealed 11th December.

Robert Oxland, of Plymouth, chemist, and John Oxland, of the same place, chemist, for improvements in the manufacture of sugar.—Sealed 15th December.

Robert Urwin, of Ashford, in the county of Kent, engineer, for certain improvements in steam-engines, which may, in whole or in part, be applicable to pumps and other machines not worked by steam power.—Sealed 15th December.

List of Patents

Granted for SCOTLAND, subsequent to November 22nd, 1849.

To John Jordan, of Liverpool, merchant and engineer, for certain improvements in the construction of ships and other vessels navigating water.—Sealed 26th November.

William Garnett Taylor, of Burton Hall, Westmoreland, for improvements in lint and in linting machines; which improvements in linting machines are in whole or in part applicable to other purposes.—Sealed 29th November.

George Buchanan, of Edinburgh, civil engineer, for improvements in cocks, valves, or stoppers, and in the use of flexible substances for regulating or stopping the passage of fluids; and also in making joints of tubes and pipes or other vessels.—Sealed 30th November.

William Edward Newton, of the Office for Patents, 66, Chancery-lane, London, civil engineer, for improvements in stoves, grates, or furnaces, and in warming or heating buildings,—being a communication.—Sealed 30th November.

Charles Morey, of the United States of America, now residing in Manchester, for certain improvements in machinery or apparatus for sewing embroidery and uniting or ornamenting, by stitches, various descriptions of textile fabrics.—Sealed 3rd December.

Thomas Worsdell, of Birmingham, manufacturer, for certain improvements in the manufacture of envelopes and cases, and in the tools and machinery used therein; parts of which may be applied to other purposes.—Sealed 7th December.

John Macintosh, of Berners-street, London, for improvements in furnaces and machinery for obtaining power, and in regulating, measuring, and registering the flow of fluids and liquids.—Sealed 10th December.

Peter Fairbairn, of Leeds, machinist, and John Hetherington, of Manchester, machinist, for certain improvements in machinery for preparing and spinning cotton, flax, and other fibrous substances,—being partly a communication.—Sealed 11th December.

Edward Lyon Berthon, of Fareham, Southampton county, clerk, for certain improvements for ascertaining and indicating the course or way, velocity, trim, and draught of ships, and the rate of currents; also for discharging water from ships, and for taking altitudes and levels at sea and on land.—Sealed 20th December.

James Smith, of Deanston, Perthshire, for certain improvements in treating the fleeces of sheep when on the animals.—Sealed 20th December.

New Patents

SEALED IN ENGLAND.

1849.

To Charles Barlow, of Chancery-lane, Esq., for improvements in the manufacture of a certain pigment,—being a communication. Sealed 29th November—6 months for inrolment.

Louis Napoleon Le Gras, of Paris, in the Republic of France, civil engineer, for improvements in the separation and disinfection of fecal matters in the manufacture of manure, and in the apparatus employed therein. Sealed 30th November—6 months for inrolment.

Walter Crum, of Thornliebank, in the county of Renfrew, in Scotland, for certain improvements in the finishing of woven fabrics. Sealed 3rd December—6 months for inrolment.

Conrad Montgomery, of the Army and Navy Club, St. James's-square, in the county of Middlesex, Esq., for improvements in brewing, distilling, and rectifying. Sealed 3rd December—6 months for inrolment.

William Eccles the Elder, William Eccles the Younger, and Henry Eccles, of Blackburn, in the county of Lancaster, cotton-spinners, for certain improvements in machinery or apparatus for preparing, spinning, and weaving cotton and other fibrous substances. Sealed 3rd December—6 months for inrolment.

Joseph Paradis, of Lyons, in the Republic of France, merchant, for improvements in the manufacture of elastic mattresses, cushions, and paddings; part of which improvements are applicable to other purposes, where sudden or continuous pressure is required to be sustained or transmitted,—being a communication. Sealed 3rd December—6 months for inrolment.

George Buchanan, of the City of Edinburgh, civil engineer, for improvements in cocks, valves, or stoppers, and in the use of flexible substances for regulating or stopping the passage of fluids; and also in making joints of tubes and pipes, or other vessels. Sealed 3rd December—6 months for inrolment.

Baron James Ulric Vaucher de Strubing, of Margaret-street, Cavendish-square, in the county of Middlesex, for improvements in the manufacture of axletree-boxes for carriages, and of the bearings of the axles of railways; and in the making of an alloy of metal suitable for such and like purposes. Sealed 3rd December—6 months for inrolment.

George Edmond Donisthorpe, of Leeds, in the county of York, manufacturer, for improvements in wheels of locomotive carriages. Sealed 3rd December—6 months for inrolment.

Peter Fairbairn, of Leeds, in the county of York, machinist, and

John Hetherington, of Manchester, for certain improvements in machinery for preparing and spinning cotton, flax, and other fibrous substances. Sealed 3rd December—6 months for inrolment.

Samuel Fisher, of Birmingham, in the county of Warwick, engineer, for improvements in railway carriages, wheels, axles, buffer and draw-springs, and hinges for railway-carriage and other doors. Sealed 5th December—6 months for inrolment.

Edward Carter, of Merton Abbey, Surrey, machinist, for improvements in printing calico and other fabrics. Sealed 5th December—6 months for inrolment.

Jonah Davies and George Davies, of the Albion Iron Foundry, Tipton, Staffordshire, engineers and ironfounders, for improvements in engines worked by steam, air, water, and other fluids; and whether locomotive, marine, or stationary; and also in boilers; the principle of which improvements is likewise applicable to blowing air and pumping water. Sealed 10th December—6 months for inrolment.

Jean Baptiste Ecarnot, of France, for improvements in the manufacture of sulphuric, sulphurous, acetic, and oxalic acids and nitrates. Sealed 10th December—6 months for inrolment.

David Christie, of No. 3, St. John's-place, Salford, in the county of Lancaster, merchant, for improvements in machinery for preparing, assorting, straightening, tearing, teasing, doubling, twisting, braiding, and weaving cotton, wool, and other fibrous substances,—being a communication. Sealed 10th December—6 months for inrolment.

John Houghton Christie, of 13, Craven-street, Strand, Esq., for an improved construction of wrought iron wheels, and machinery for effecting the same,—being a communication. Sealed 10th December—6 months for inrolment.

Thomas Grimsley, of the City of Oxford, sculptor, for improvements in the manufacture of bricks and tiles. Sealed 10th December—6 months for inrolment.

The Baron Louis Lo Presti, of Paris, in the Republic of France, for improvements in hydraulic presses, which are in whole or in part applicable to pumps, and other like machines. Sealed 10th December—6 months for inrolment.

William Holt, of Preston-place, Bradford, organ builder, for certain improvements in the construction of the pallets or valves of organ sound-boards or wind-chests,—the same being applicable to seraphines, eolophons, harmonicums, harmoniums, and all other musical instruments in which the tone is produced by the admission of wind, supplied by bellows or other machinery, to pipes, reeds, or springs, and played upon by a keyboard or key-boards; and also to various other purposes connected with all the above-named musical instruments. Sealed 10th December—6 months for inrolment.

John Henry Jenkinson, of Salford, in the county of Lancaster, machine maker, and Thomas Priestley, of Shuttleworth, in the same county, manager, for certain improvements in machinery or apparatus to be used for preparing, spinning, and doubling cotton, wool, flax, silk, and similar fibrous materials. Sealed 12th December—6 months for inrolment.

William Birkmyre, of Fulbeck Cottage, Hampstead, chemist, for improvements in the manufacture and refining of sugar. Sealed 12th December—6 months for inrolment.

Robert Harcourt, of Birmingham, manufacturer, for certain improvements in knobs, handles, and fastenings for doors and drawers, and in fastenings to be used in fastening window-sashes, curtain and other rods; and for other like purposes. Sealed 15th December—6 months for inrolment.

James Oldknow, of Lille, in France, lace manufacturer, for improvements in the manufacture of lace and other fabrics. Sealed 15th December—6 months for inrolment.

Henry Roberts, of Connaught-square, Hyde-park, Gent., for improvements in the manufacture of bricks and tiles. Sealed 15th December—6 months for inrolment.

George Wythes, of Reigate, in the county of Surrey, contractor, for improvements in apparatus for receiving and retaining the rails of railways. Sealed 15th December—6 months for inrolment.

Alfred Dalton, of West Bromwich, in the county of Stafford, iron-founder, for improvements in reverberatory and other furnaces. Sealed 15th December—6 months for inrolment.

Charles Cowper, of Southampton-buildings, Chancery-lane, patent agent, for improvements in instruments for measuring, indicating, and regulating the pressure of air, steam, and other fluids; and in instruments for measuring, indicating, and regulating the temperature of the same; and in instruments for obtaining motive power from the same,—being a communication. Sealed 15th December—6 months for inrolment.

Charles Lizars, of Paris, engineer, for improvements in gas-meters,—being a communication. Sealed 15th December—6 months for inrolment.

Thomas Rock Shute, of Watford, in the county of Hertford, silk throwster, for improvements in spinning, doubling, and throwing Organzine silk. Sealed 15th December—6 months for inrolment.

Timothy Hackworth and John Wesley Hackworth, of the Soho Works, Shilden, in the county of Durham, engineers, for improvements in locomotive and other engines. Sealed 15th December—6 months for inrolment.

Benjamin Fawcett, of Old Jewry, in the City of London, builder, for improvements in pigments, paints, and vehicles for painting. Sealed 15th December—6 months for inrolment.

Isaac Lewis Pulvermacher, of Vienna, engineer, for improvements in galvanic batteries in electric telegraphs, and in electro-magnetic and magneto-electric machines. Sealed 15th December 6 months for inrolment.

Richard Hobson, of Leeds, in the county of York, Doctor of Medicine, for certain improvements in the manufacture of horse-shoes, and in apparatus for taking the measurement of horse-shoes or horses' hoofs. Sealed 15th December—6 months for inrolment.

Edward Lyon Berthon, of Fareham, in the county of Southampton, clerk, Master of Arts, for certain improvements for ascertaining and indicating the course or way, velocity, trim, and draught of ships, and the rate of currents; also for discharging water from ships, and for taking altitudes and levels at sea and on land. Sealed 19th December—6 months for inrolment.

James Smith, of Deanstone, in the county of Perth, for certain improvements in treating the fleeces of sheep when on the animals. Sealed 19th December—6 months for inrolment.

William Ackroyd, of Birkenshaw Mills, near Leeds, in the county of York, for improvements in dressing and cleaning worsted and worsted mixed with cotton and other fabrics, after they have been woven,—being a communication. Sealed 19th December—6 months for inrolment.

Warren De la Rue, of Bunhill-row, in the county of Middlesex, manufacturer, for improvements in the manufacture of envelopes. Sealed 19th December—6 months for inrolment.

Frederick Hale Thomson, of Berners-street, Oxford-street, and Edward Varnish, of Kensington, in the county of Middlesex, for improvements in the manufacture of ink-stands, mustard-pots, and other vessels, of glass. Sealed 19th December—6 months for inrolment.

Henry Fox Talbot, of Lacock Abbey, in the county of Wilts., Esq., and Thomas Augustine Malone, of Regent-street, in the county of Middlesex, photographers, for improvements in photography. Sealed 19th December—6 months for inrolment.

Joseph Whitworth, of Manchester, engineer, for certain improvements in machinery or apparatus for cutting metals, and also improvements in machinery or apparatus applicable to agricultural and sanatory purposes. Sealed 19th December—6 months for inrolment.

Frederick George Spray, and George Nevett, of Hampstead-road, engineers, for an improved steam-engine; parts of the arrangements of which may be applied to apparatus for regulating, measuring, and registering the flow of liquids and gases. Sealed 19th December—6 months for inrolment.

CELESTIAL PHENOMENA FOR JANUARY, 1850.

D.	H.	M.	
1			Clock before the ⊙ 3m. 51s.
—			☽ rises 8h. 8m. A.
—			☽ passes mer. 2h. 3m. M.
—			☽ sets 10h. 0m. M.
—			Occul. 45 Leonis, im. 18h. 30m. em. 19h. 25m.
2	6	13	☿ in conj. with Pallas, diff. of dec. 25. 24. S.
3	4	25	♃ in conj. with the ☽ diff. of dec. 1. 16. S.
	11	7	♃'s third sat. will im.
	14	26	♃'s third sat. will em.
3	19	9	☿ greatest hel. lat. S.
4	14	5	♃'s first sat. will im.
5			☽ in □ or last quarter
—			Clock before the ⊙ 5m. 41s.
—			☽ rises Morn.
—			☽ passes mer. 5h. 57m. M.
—			☽ sets 11h. 52m. M.
6	16	38	♀ in the descending node
7	22		♃ stationary
9	12	43	♃'s second sat. will im.
9	21	51	Vesta oppo. to the ⊙ intens. of light 0·693.
10			Clock before the ⊙ 8m. 50s.
—			☽ rises 5h. 15m. M.
—			☽ passes mer. 9h. 46m M.
—			☽ sets 2h. 14m. A.
	18	23	♃'s third sat. will em.
11	15	59	♃'s first sat. will im.
	20	0	☽ in Apogee
	21	20	♀ in conj. with the ☽ diff. of dec. 3. 50. S.
12	9	58	♅ in □ with the ⊙
—			Ecliptic conj. or ● new moon
13	20	51	Juno in □ with the ⊙
14	12	15	☿ in conj. with the ☽ diff. of dec. 2. 45. S.
	18	48	☿ in conj. with Ceres, diff. of dec. 5. 14. N.
15			Clock before the ⊙ 9m. 44s.
—			☽ rises 8h. 57m. M.
—			☽ passes mer. 1h. 42m. A.
—			☽ sets 6h. 32m. A.
16	15	17	♃'s second sat. will im.
17			Mercury R. A. 21h. 8m. dec. 17. 40. S.
—			Venus R. A. 19h. 10m. dec. 22. 52. S.
—			Mars R.A. 5h. 7m. dec. 26.13. N.
—			Vesta R. A. 7h. 19m. dec. 23. 54. N.
—			Juno R.A. 13h. 35m. dec. 6.11. S.
—			Pallas R. A. 19h. 50m. dec. 1. 38. N.
—			Ceres R. A. 20h. 58m. dec. 23. 57. S.
—			Jupiter R. A. 11h. 36m. dec. 4. 1. N.
17			Saturn R. A. 0h. 14m. dec. 0. 59. S.
—			Georg. R. A. 1h. 24m. dec. 8. 13. N.
—			Mercury passes mer. 1h. 22m.
—			Venus passes mer. 23h. 26m.
—			Mars passes mer. 9h. 19m.
—			Jupiter passes mer. 15h. 47m.
—			Saturn passes mer. 4h. 27m.
—			Georg. passes mer. 5h. 37m.
	19	2	♃'s third sat. will im.
18	17	8	♄ in conj. with the ☽ diff. of dec. 1. 3. N.
		52	♃'s first sat. will im.
20			Clock before the ⊙ 11m. 21s.
—			☽ rises 11h. 3m. M.
—			☽ passes mer. 5h. 30m. A.
—			☽ sets Morn.
	3	7	♅ in conj. with the ☽ diff. of dec. 4. 9. N.
	12	20	♃'s first sat. will im.
21			Occul. ζ^2 Ceti, im. 5h. 4m. em. 5h. 50m.
	9		Pallas in conj. with the ⊙
—			☽ in □ or first quarter.
—			Occul. *f* Tauri, im 9h. 57m. em. 10h. 52m.
22	13	29	☿ greatest elong. 18. 32. E.
	18	46	☿ in the ascending node
23	11	5	♂ stationary
—			Occul. *y* Tauri, im. 5h. 4m. em. 5h. 50m.
—			Occul. 71 Tauri, im. 8h. 57m. em.
—			Occul. θ^1 Tauri, im. 9h. 42m. em. 10h. 49m.
—			Occul. θ^2 Tauri, im. 9h. 49m. em. 10h. 43m.
—			Occul. B.A.C., 1391, im. 10h. 47m. em. 11h. 52m.
—			Occul. *a* Tauri, im. 13h. 32m. em. 14h. 1m.
	17	53	♃'s second sat. will im.
24			Occul. 115 Tauri, im. 8h. 16m. em. 9n. 29m.
	4	5	♂ in conj. with the ☽ diff. of dec. 8. 6. N.
25			Clock 12m. 39s.
—			☽ rises 2h. 4m. A.
—			☽ passes mer. 10h. 5m. A.
—			☽ sets 5h. 1m. M.
26	16	0	☽ in Perigee
	16	48	♀ in conj. with Pallas, diff. of dec. 23. 10 N.
27	8	21	☿ in Perihelion.
	14	13	♃'s first sat. will im.
28	13	48	☿ stationary.
30	12	44	♃ in conj. with the ☽ diff. of dec. 1. 11. S.

J. LEWTHWAITE, Rotherhithe.

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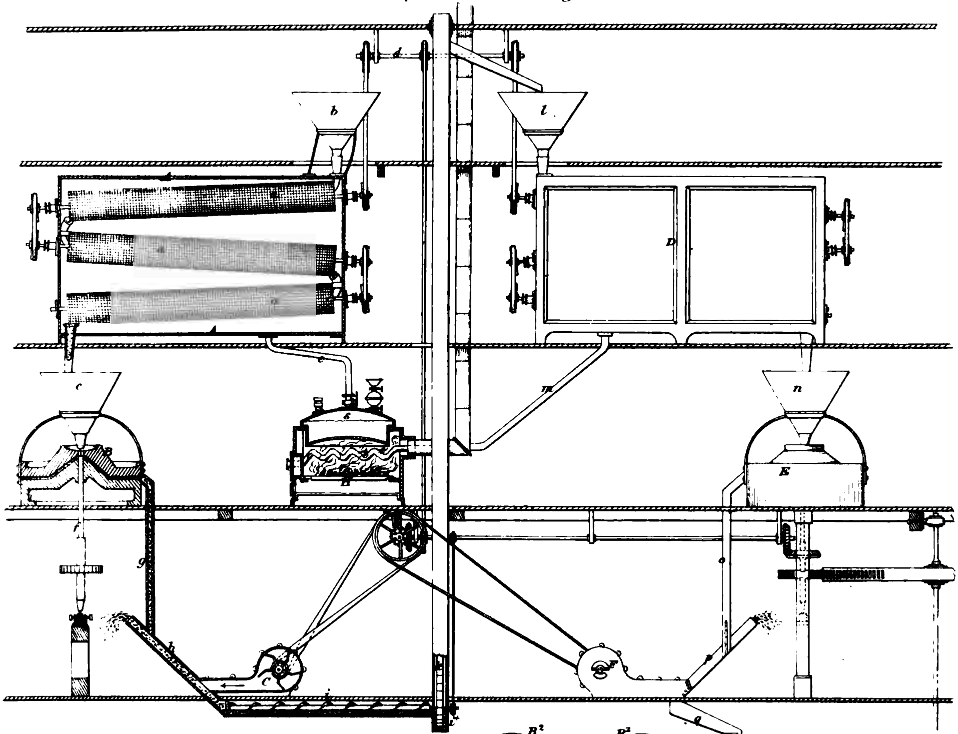

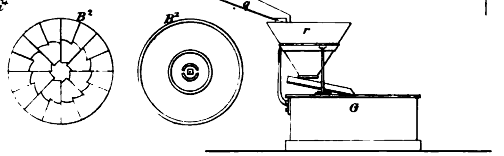

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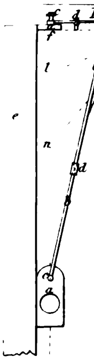

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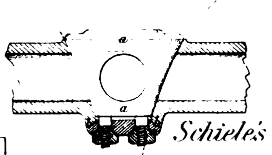
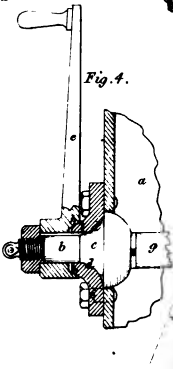


Schiele's imp.ts in axles, bearings, &c.

Fig. 4.



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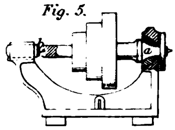

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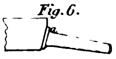

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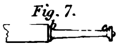

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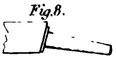

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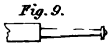

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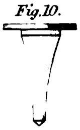

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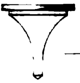

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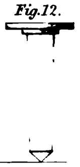

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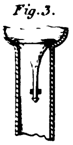

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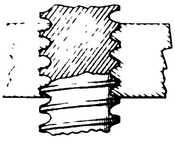
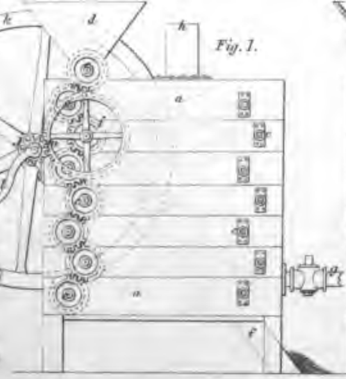
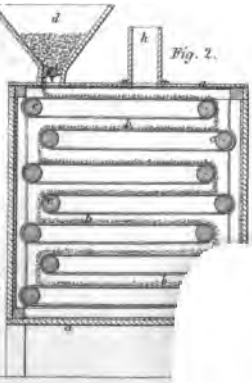


Bethell's app.ts for drying seeds.





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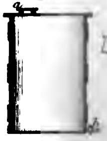
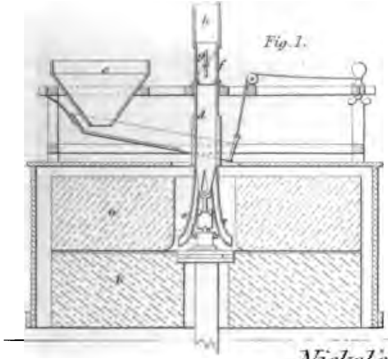


Newton del.

2d August 1848.

M^c Clellan's imp^d corn mill.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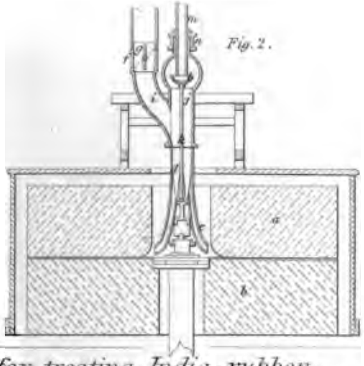
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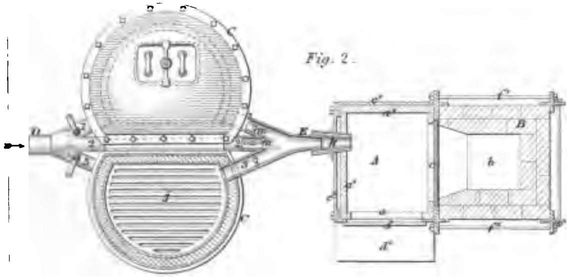


Fig. 2.

Newton's app^ts for manufacturing steel.

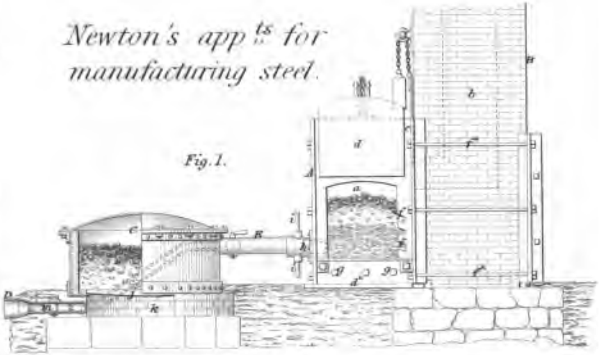
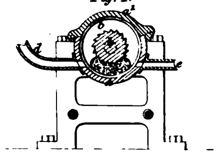


Fig. 1.

Nickels' app^ts for treating India-rubber.—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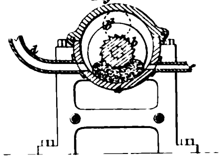
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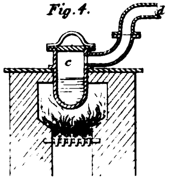
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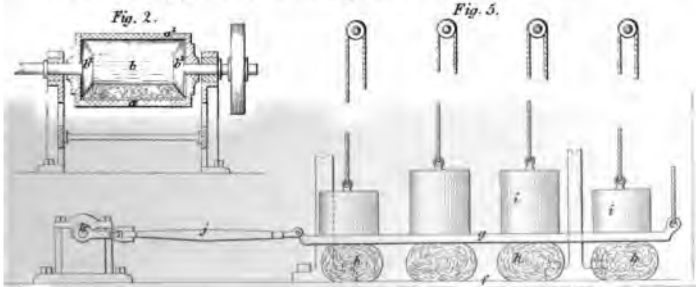
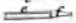


Fig. 2.
Fig. 5.

Loam's imp^ts in manufacturing fuzees.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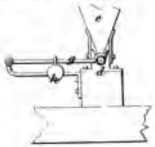
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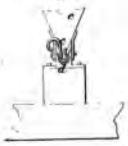
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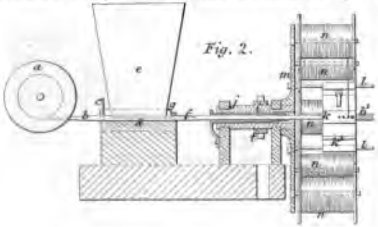
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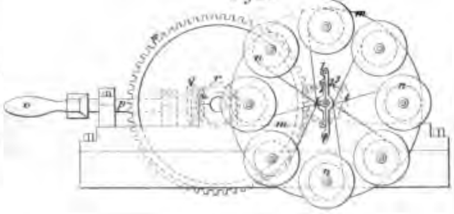


Fig. 1.

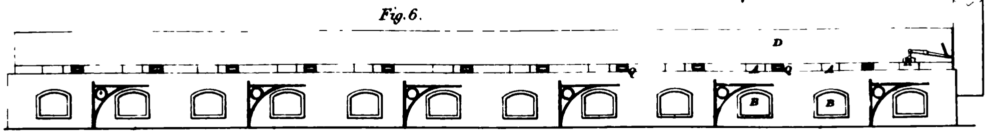
Newton del.

1st August 1849.

W.A. Beever sc.

Wilkinson's imp.ts in coke ovens.

Fig. 6.



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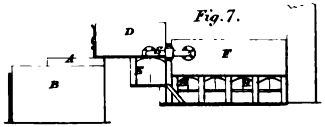

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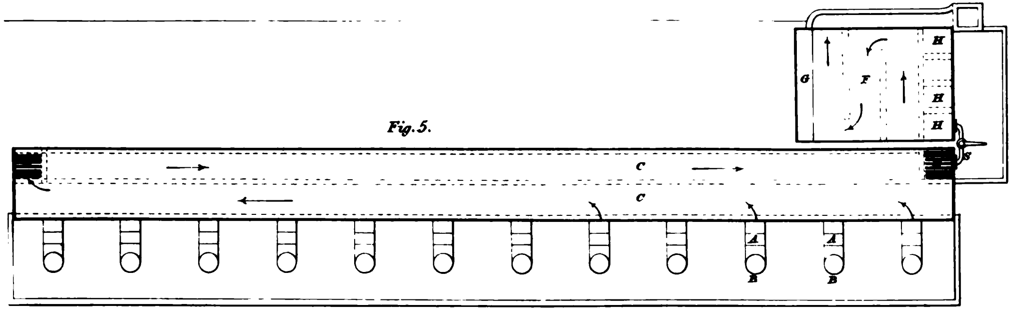

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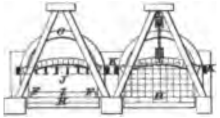

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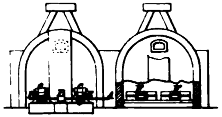

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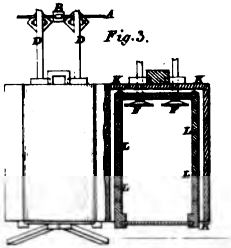

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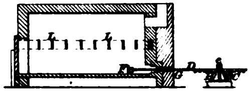

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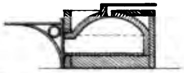
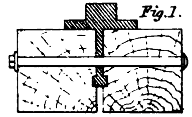


Imp.d mode of supporting rails.

Fig. 1.



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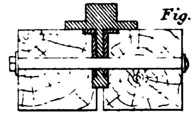

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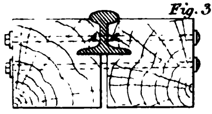
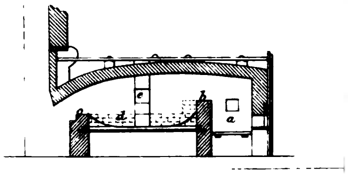
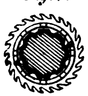


Williams' puddling furnace.



Hobler's imp.d windlasses, &c.

Fig. 4.



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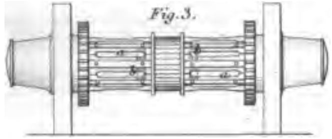

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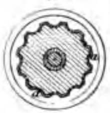

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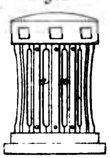
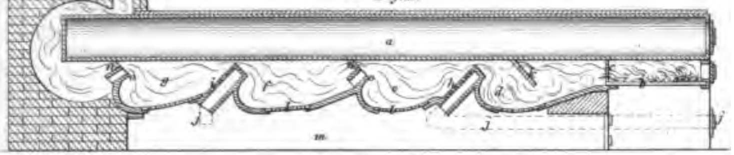


Baker's imp.d furnace.

Fig. 1.



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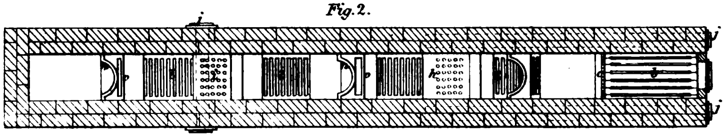
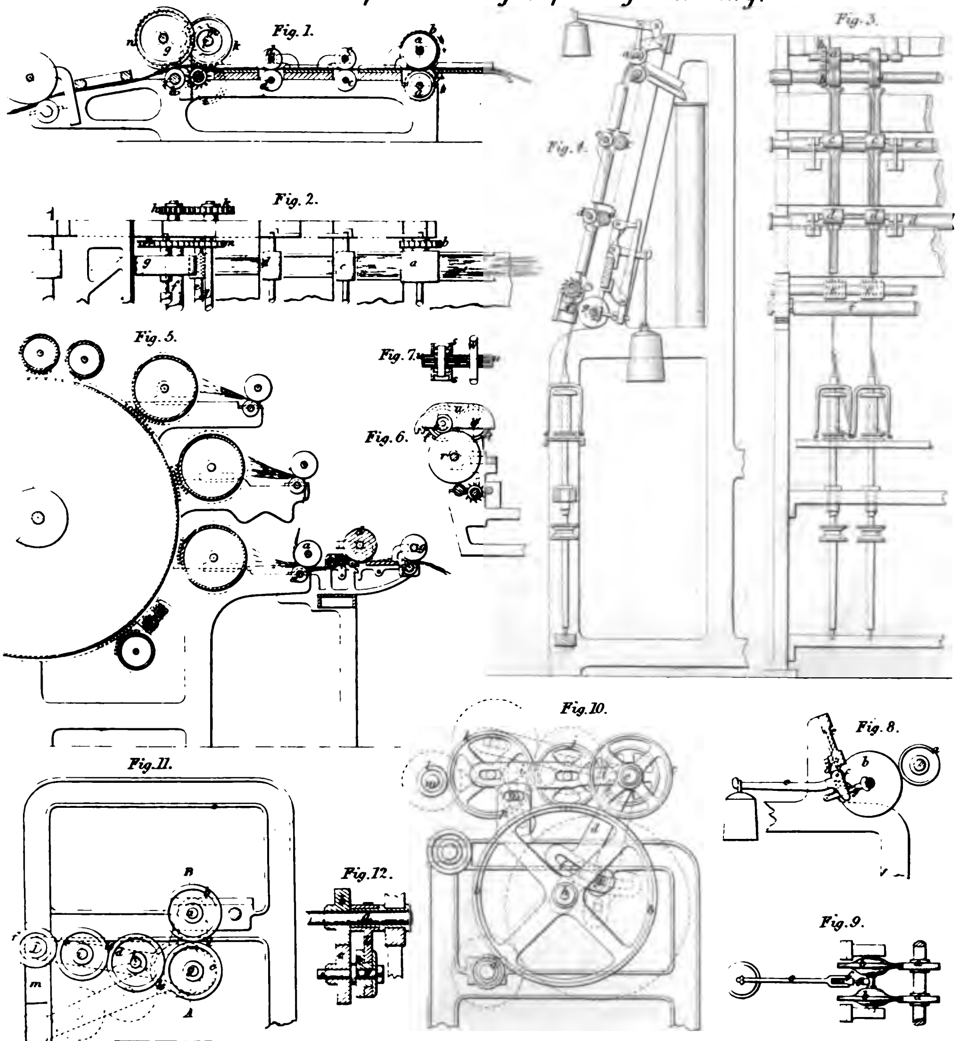
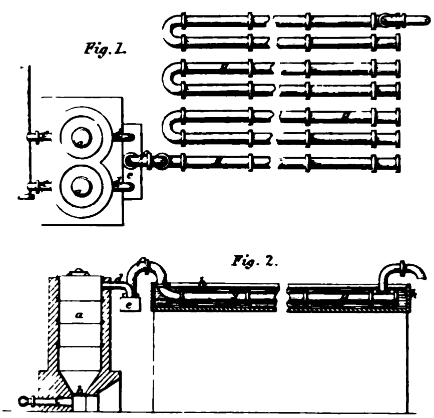


W. Newton del. 1st August 1849. T. Sherratt sc.

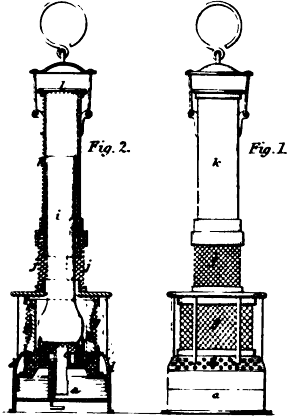
Fairbairn's imp.ts in drawing & spinning machinery.

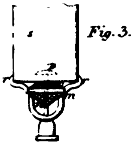


Reece's imp.ts in treating peat.

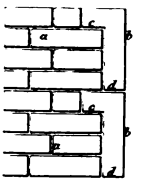


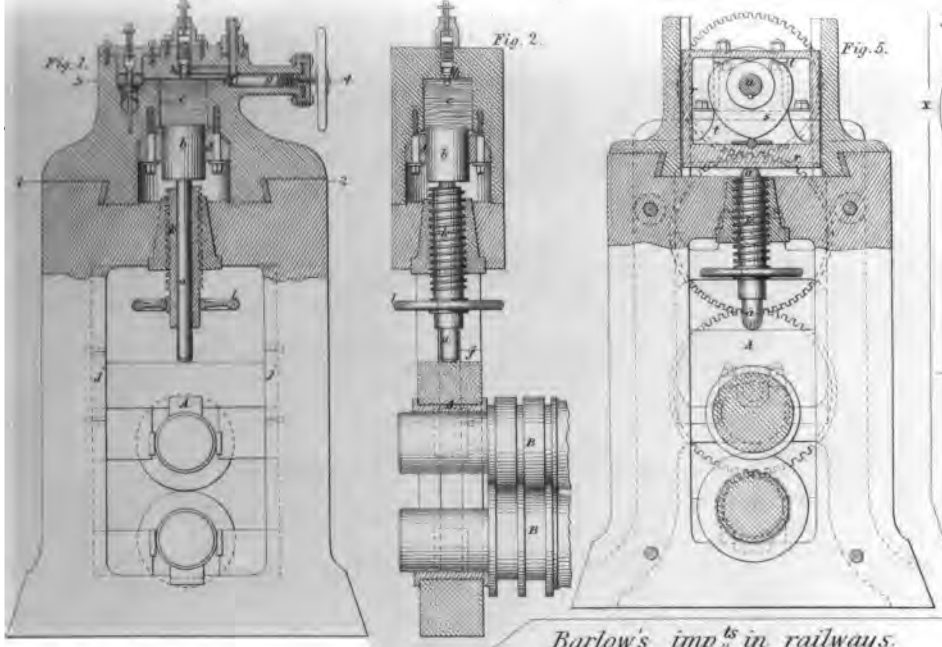
Parish's lamps & burners.

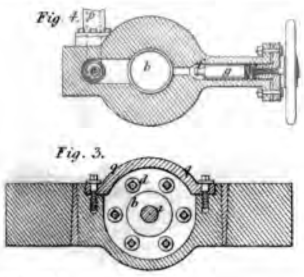




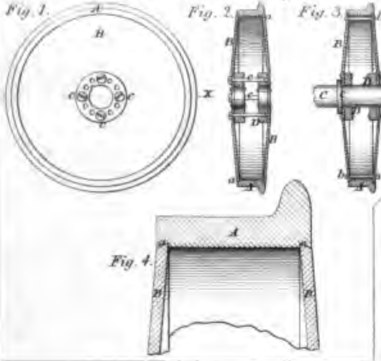
Taylor's imp.ts in building.



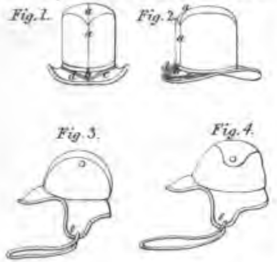


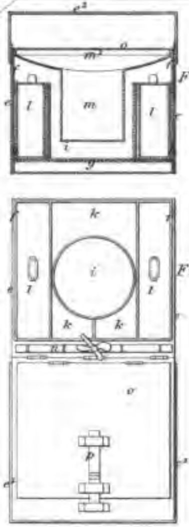


Newton's railway wheels.

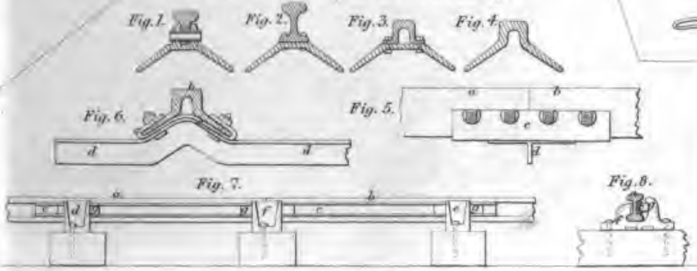


Tyler's imp^{d} hats & hat-cases.

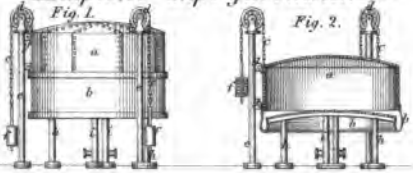




Barlow's imp^{ts} in railways.



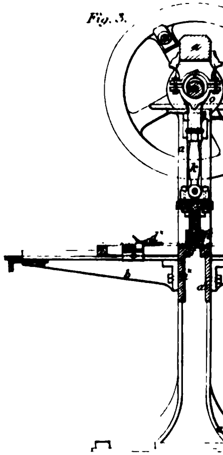
Knapton's imp^{d} gasometer.



W. Newton del. 1st Septr 1849. T. Sherratt sc.

Archer's imp.ts in stamping paper.

Fig. 3.



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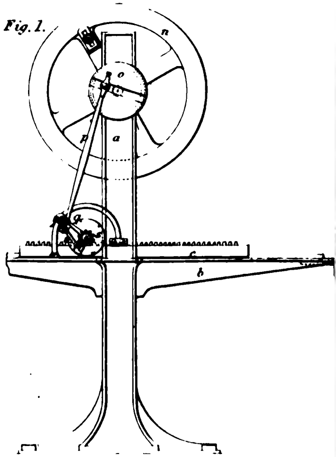

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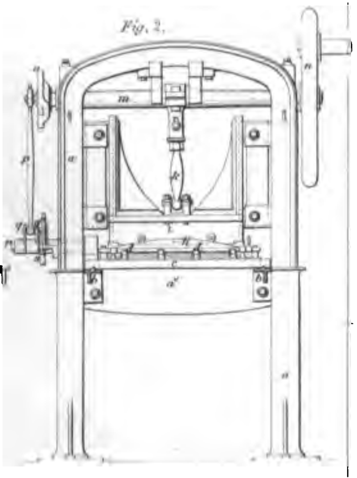

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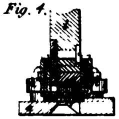

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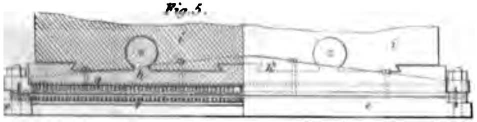

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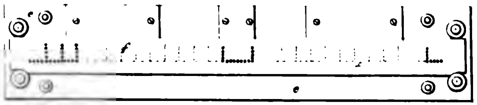
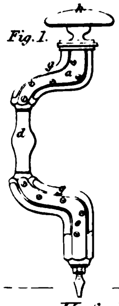


Cartwright's imp.d brace.

Fig. 1.



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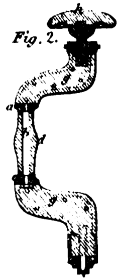

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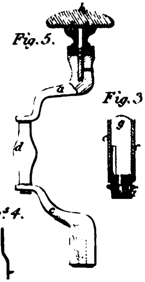

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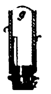

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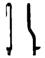
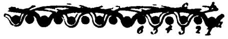


Keſselmeyer & Mellodew's imp.ts in weaving velvets.

Fig. 1.



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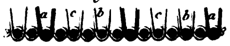

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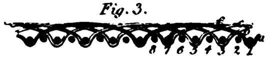

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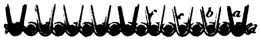

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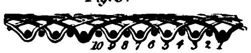

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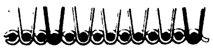

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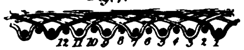

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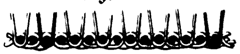

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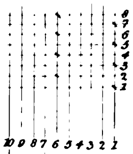

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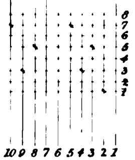

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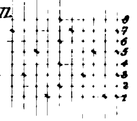

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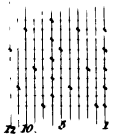

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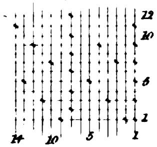

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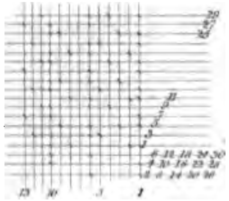

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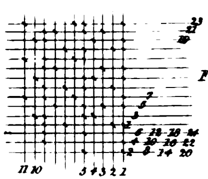

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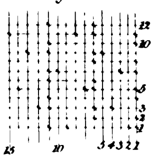
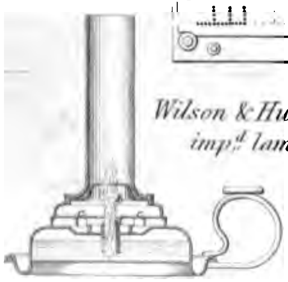


Wilson & Humfrey's imp.d lamp.



1st Septr 1849.

Spencer's impts in manufacturing tubes, &c.

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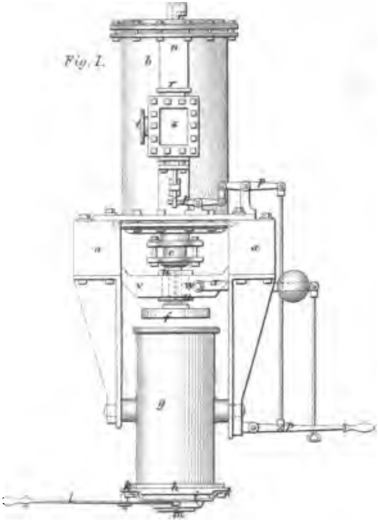

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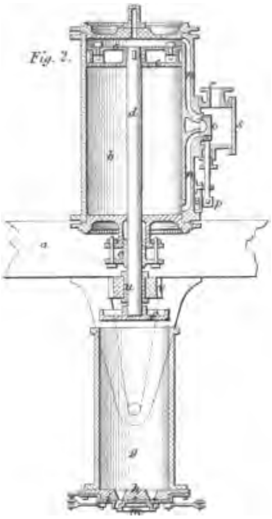

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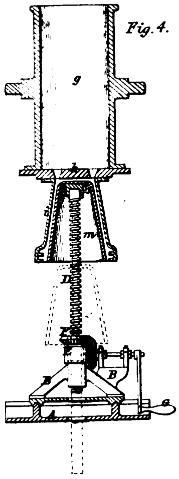

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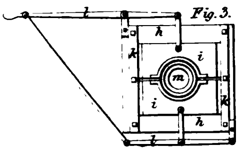

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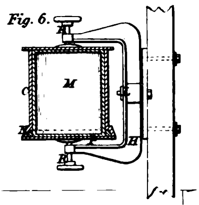

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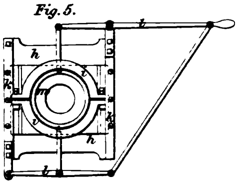
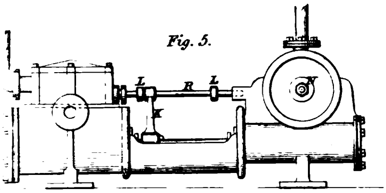


Newton's impts in engines & pumps.

Fig. 5.



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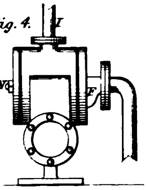

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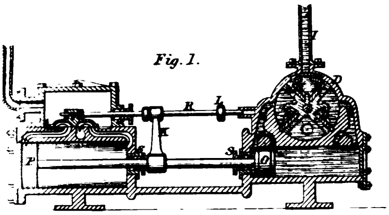

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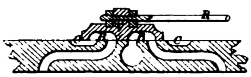

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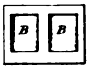
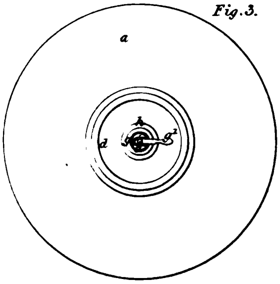


Brooke's impts in lamps.

Fig. 3.



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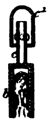

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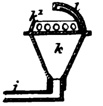

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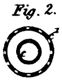

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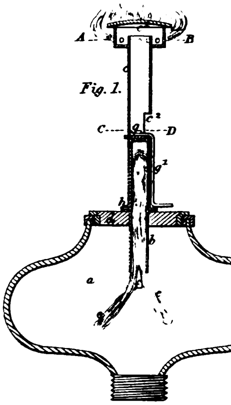

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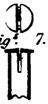

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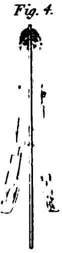

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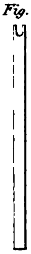

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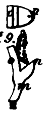
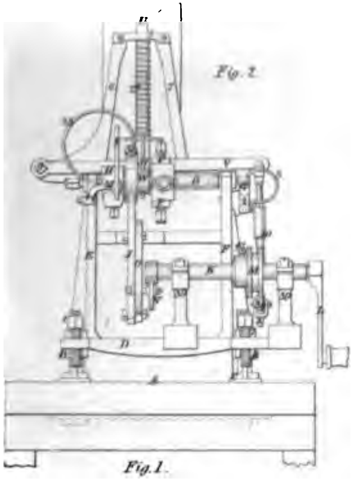


[illegible] del. 1st October 1849. W.A.Beever sc.

Newton's imp^ts in casting printing types.



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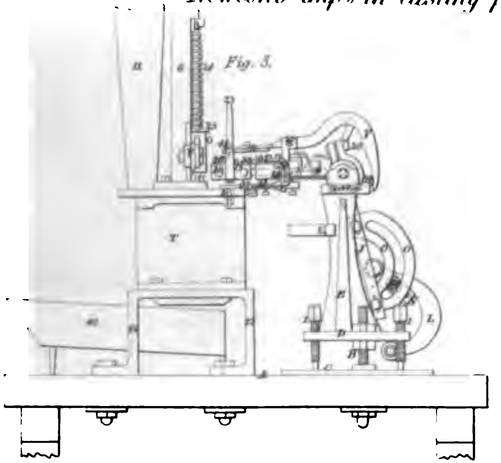

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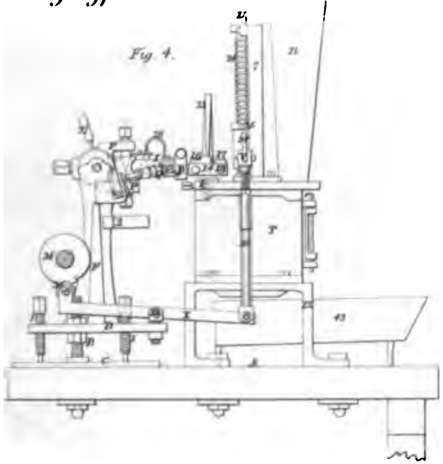

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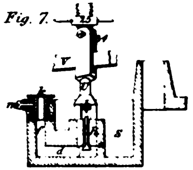

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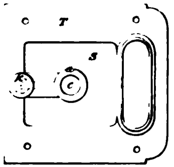

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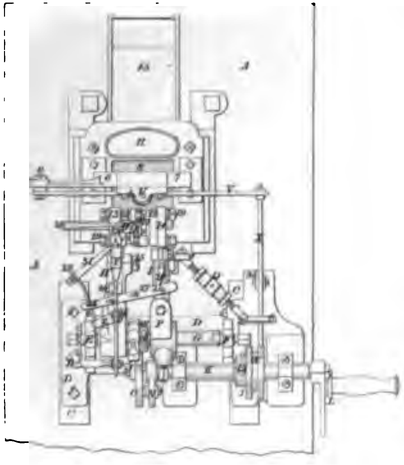

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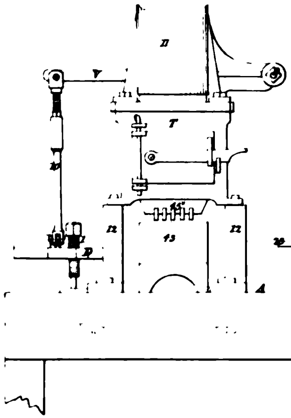

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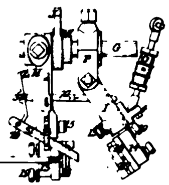
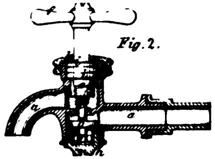


Fig. 6.

Llewellin & Hemmons' cocks.



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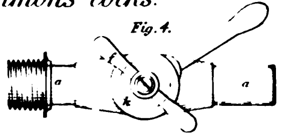

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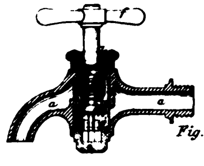

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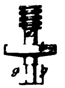

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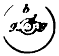

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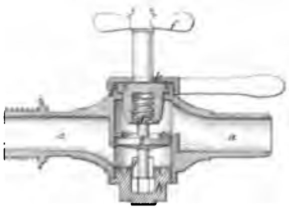


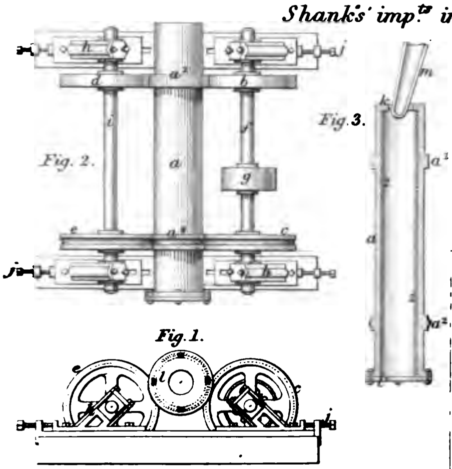
Fig. 3.

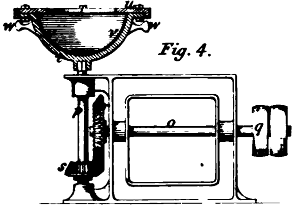
W. Newton del.

1st October 1843

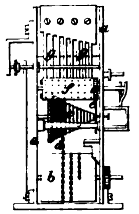
T. Sherratt sc.

Shank's' impts in casting pipes &c.

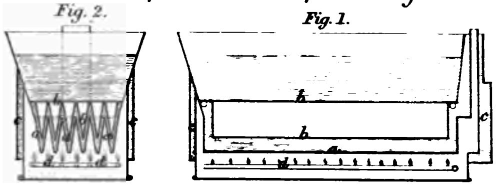




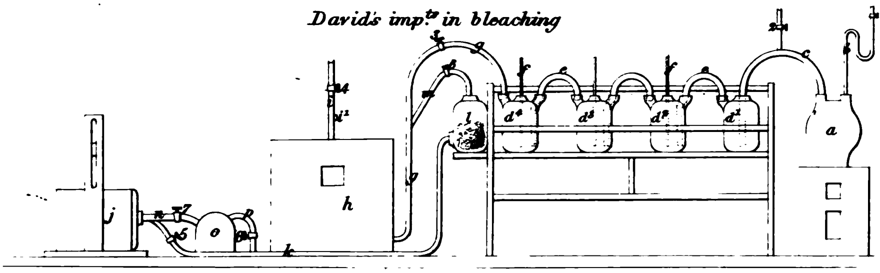
Payne's impts in clocks



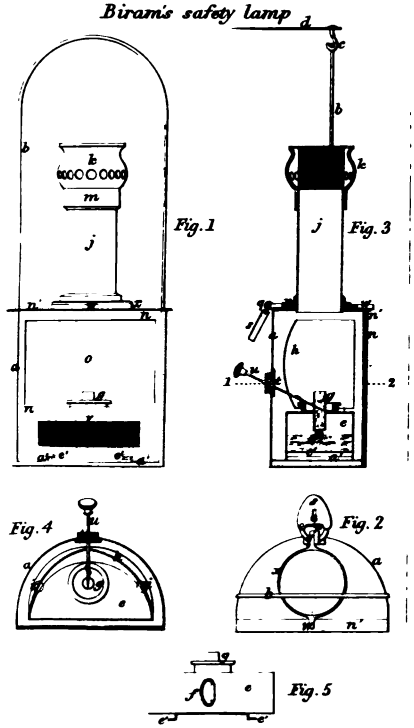
Depies & Pettit's impts in heating



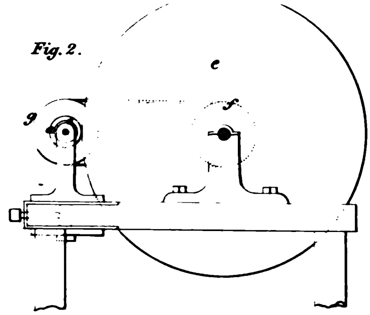
David's impts in bleaching

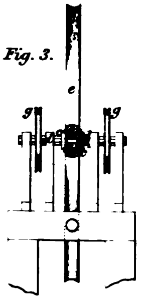


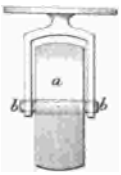
Biram's safety lamp



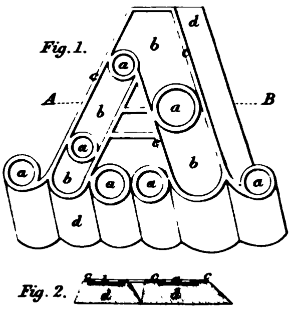
Forlong's impd castors







Moore's impts in letters



Newton's imp^{ts} in steam engines

Fig. 5

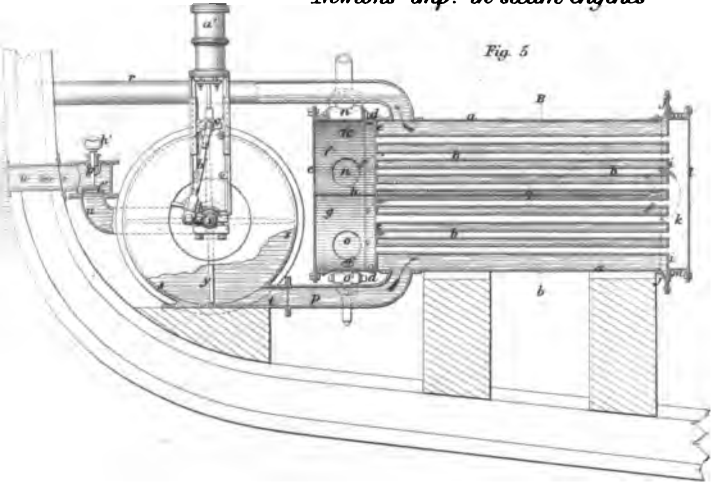


Fig. 3

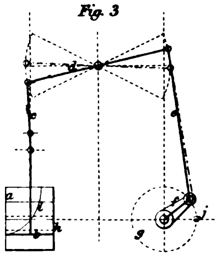


Fig. 4

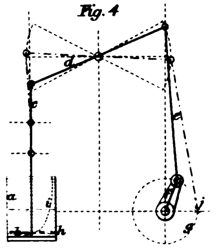


Fig. 1

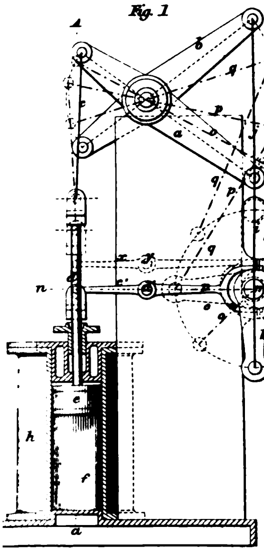
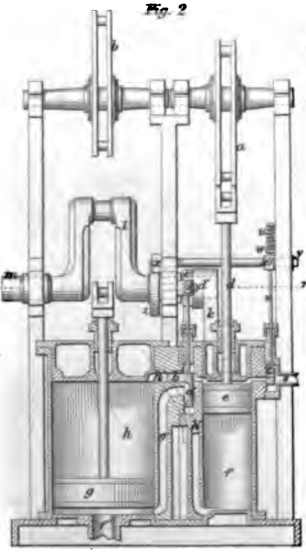


Fig. 2



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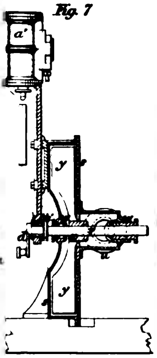

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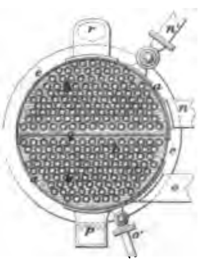


Greening's knife handle

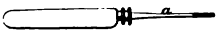


Fig. 2

Fig. 3

Fig. 1

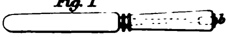
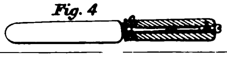


Fig. 4



Fontain Moreau's app^{ts} for treating fatty bodies

Fig. 2

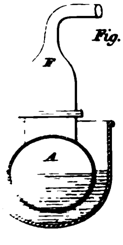


Fig. 1

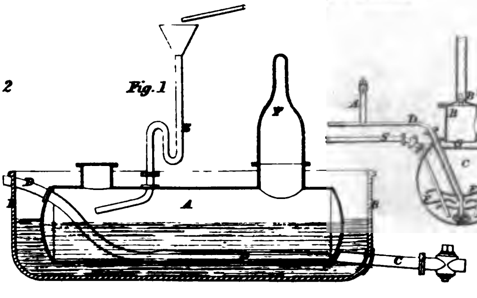
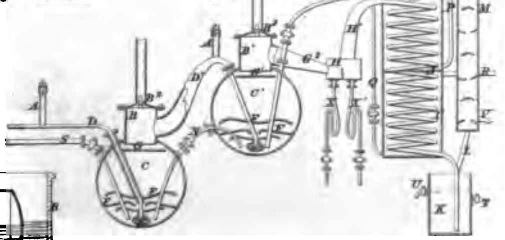
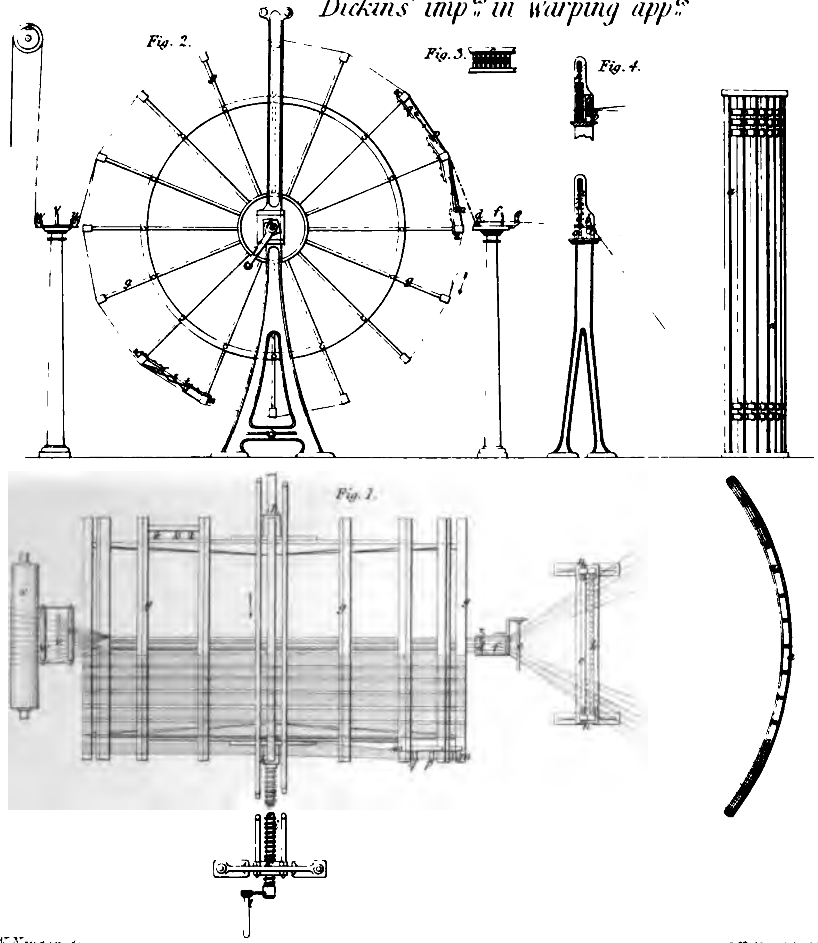


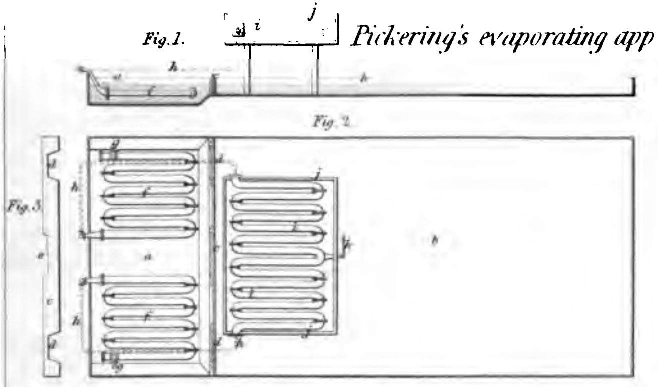
Fig. 3



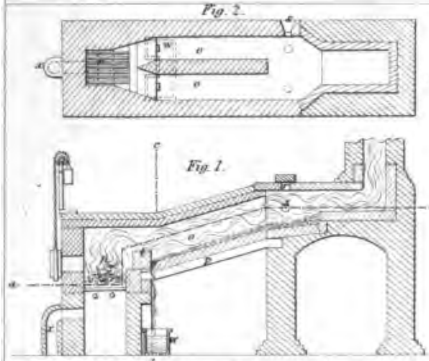
Dickins' imp^ts. in warping app^ts.



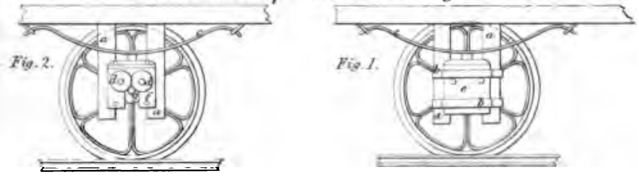
Pickering's evaporating app^ts.



Balmain & Parnell's imp^d. glaſs furnace.



Brandt's imp^d. axle bearings.



W. Newton del.

1st Nov. 1849.

T. Sharratt sc.

… in manufacturing pyroligneous acids.

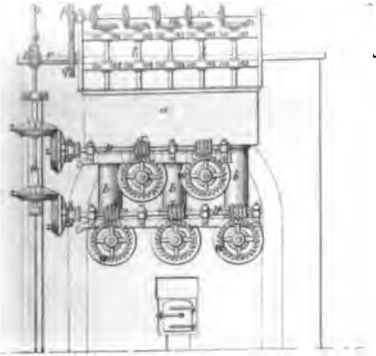
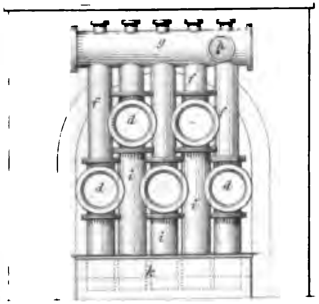
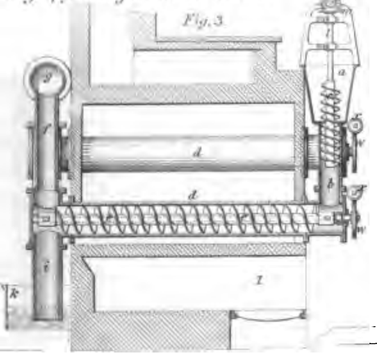


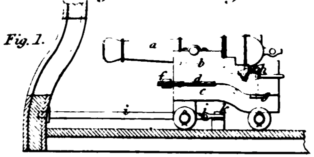
Fig. 2.





Woollett's gun carriages.

Fig. 1.



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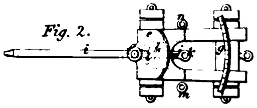

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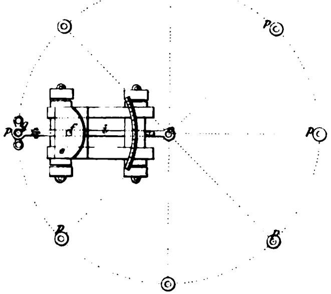


Parry's imp^ts in horse shoes.

Fig. 1.

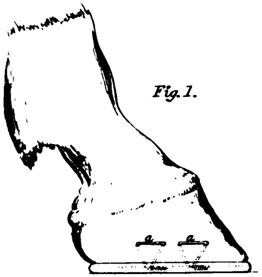
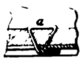


Fig. 3.



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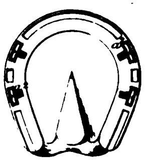

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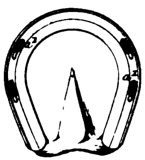
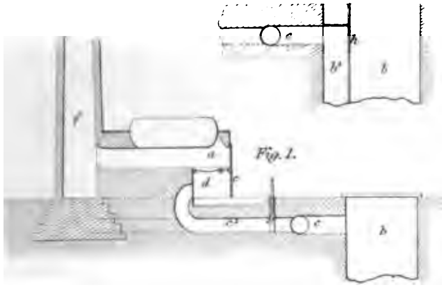


Gordon's app^ts for ventilating mines.

Fig. 3.

Fig. 1.



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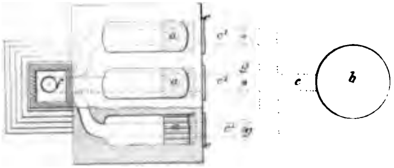


Carpenter's imp^d fastening.

Fig^s 3 4

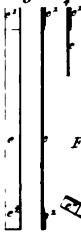
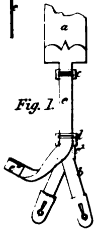


Fig. 1.



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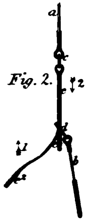
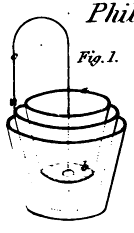


Philipp's galvanic app^ts

Fig. 1.



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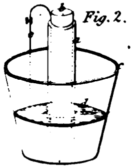

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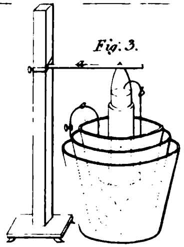
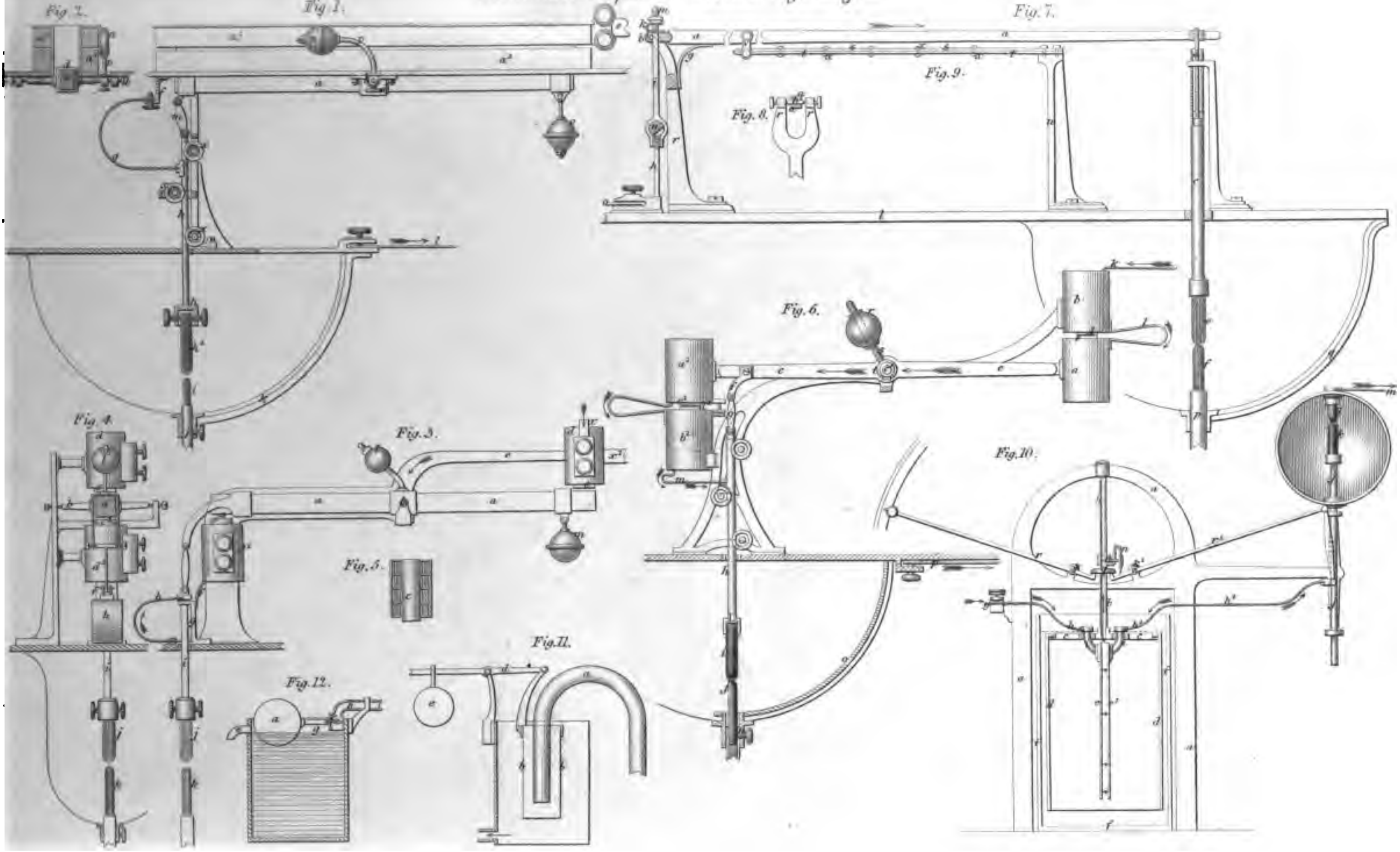


1^st November 1849.

J. F. Wood sc.

Allman's imp.ts in electric lighting.



W. Newton del. 1st Dec.r 1849. W.A. Beever sc.

Simpson & Forster's appts for preparing solvents.

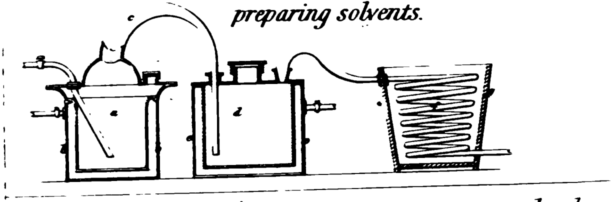
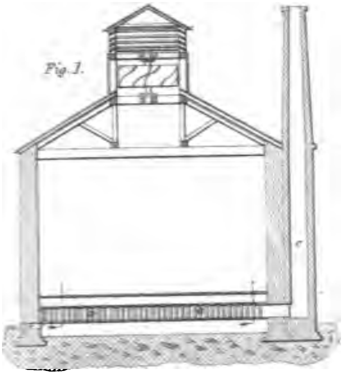
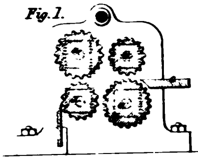


Fig. 1.



Barsham's appts for preparing cocoa nut husks.

Fig. 1.



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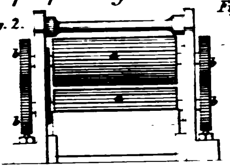

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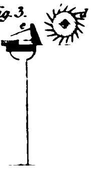
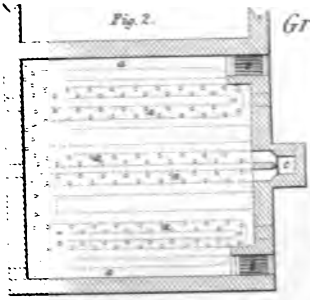


Green's impts in preparing fuel.

Fig. 2.



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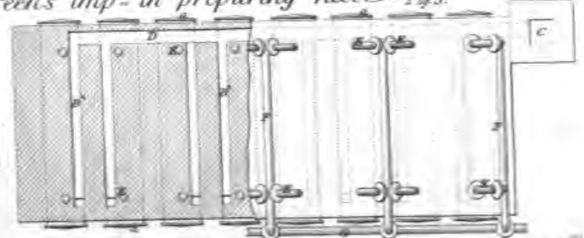

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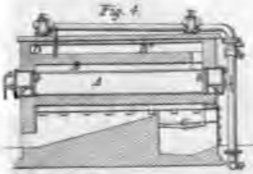

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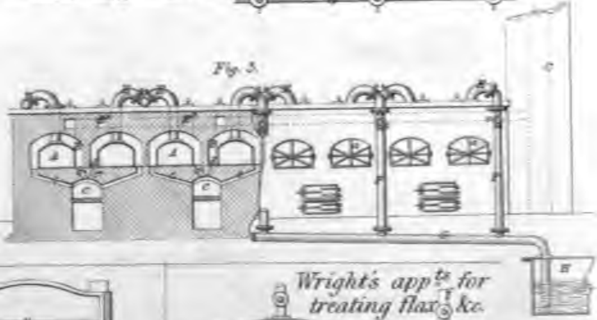

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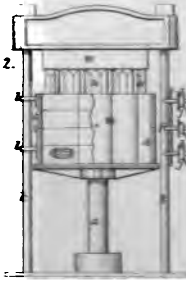

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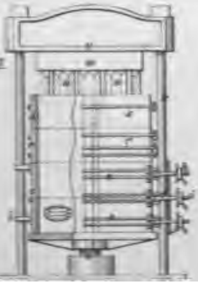
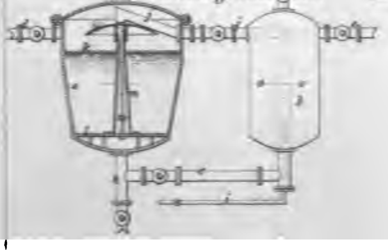


Wright's appts for treating flax &c.



Kennedy's impts in packing cops.

Fig. 3.

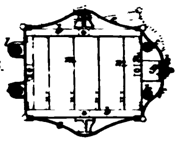
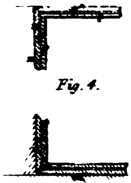
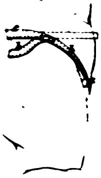


Fig. 4.



Wilson's impd truss.

Fig. 1.



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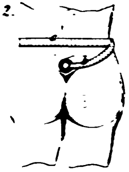

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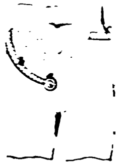


W. Newton del. [illegible] 1849.

Kilner's imp^ts in wheels & axles.

Fig. 1.

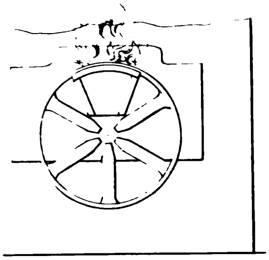
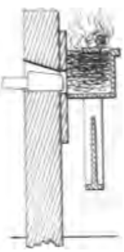


Fig. 2.



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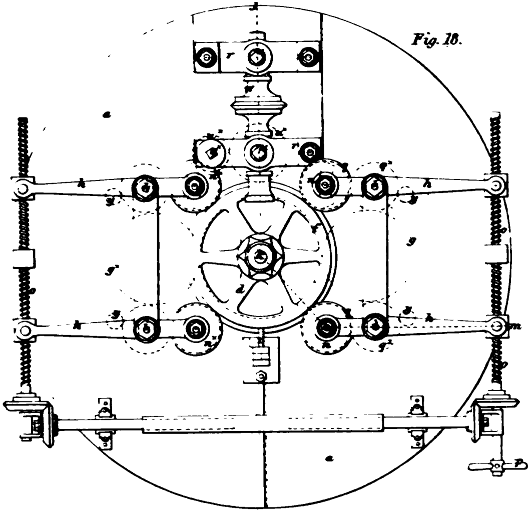


Fig. 3.

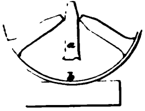


Fig. 6.

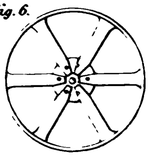


Fig. 4.

Fig. 8.

Fig. 5.

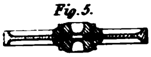


Fig. 19.*

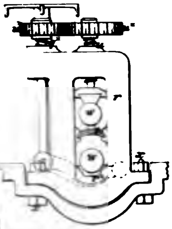


Fig. 19.

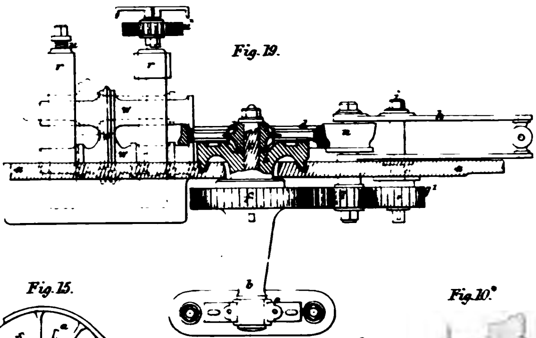
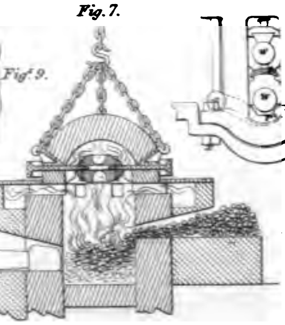


Fig.^s 9.

Fig. 7.



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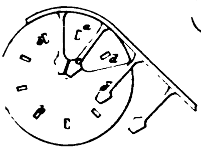
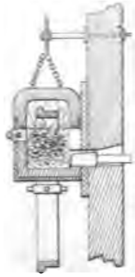


Fig. 10.*



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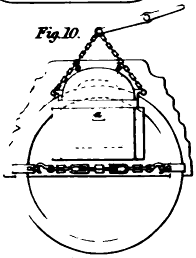

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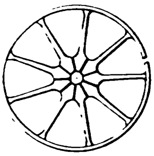

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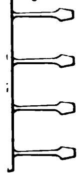


Fig.^s

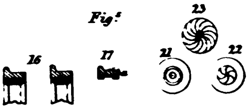
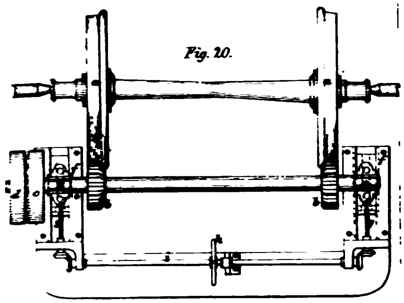


Fig. 11.

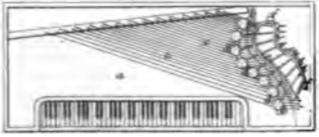
Fig. 12.

Fig. 20.



Parker's imp^ts in piano-fortes.

Fig. 1.



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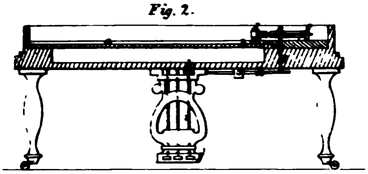
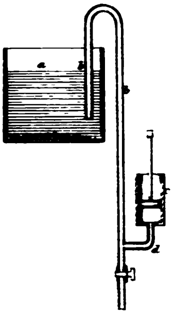


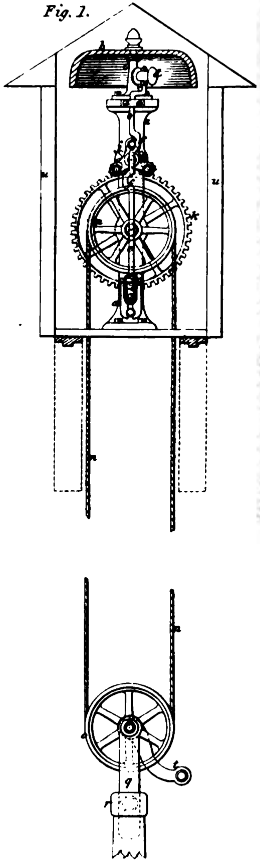
Horsley's purifying water.



Newton del. 1^st December 1849. T. Sherratt

Colegrave's imp.d signal apparatus.

Fig. 1.



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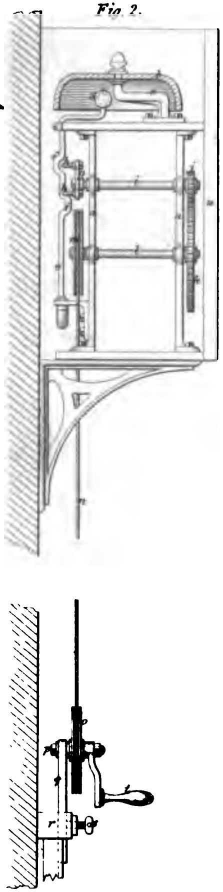

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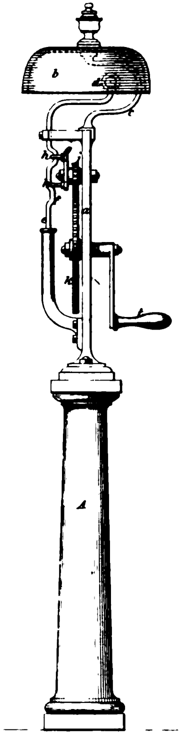

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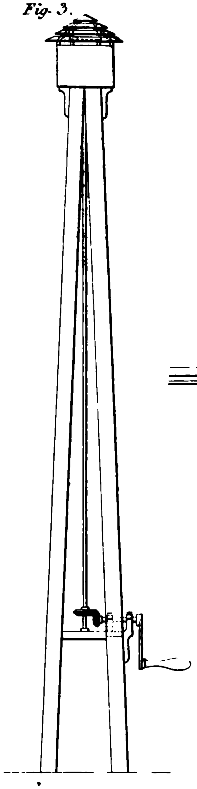
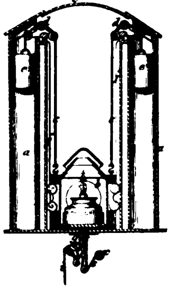


Fig. 5.



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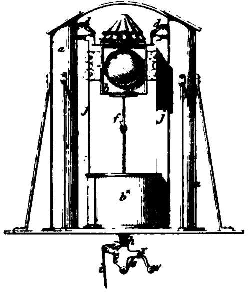

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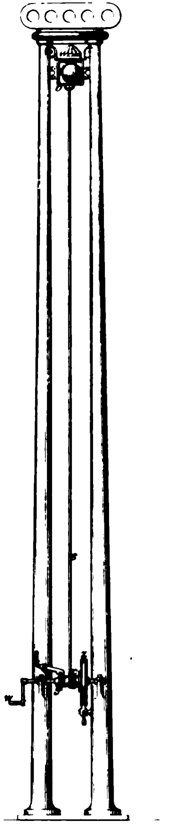
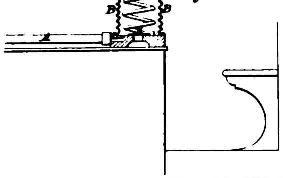


Fig. 10.



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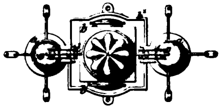
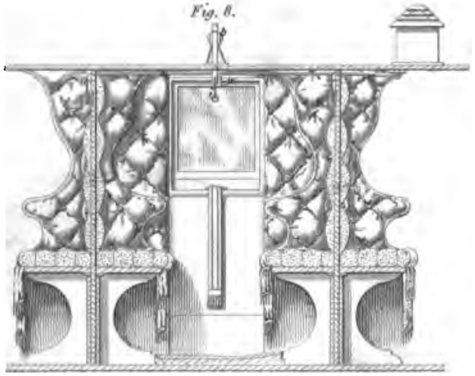


Fig. 8.



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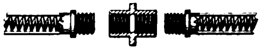

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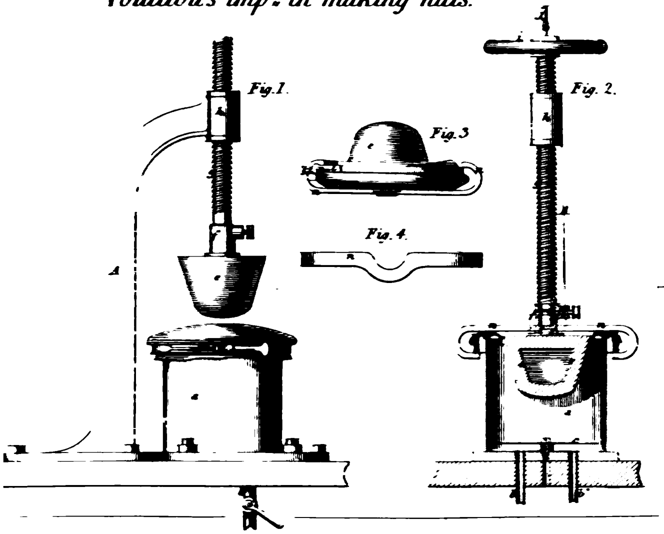
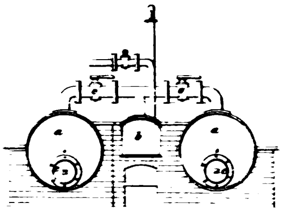
W.A.Beever sc.

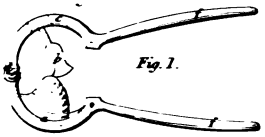
Vouillou's impts in making hats.

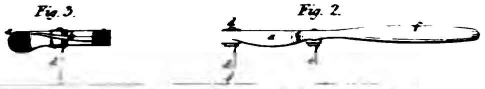


Tuckett's appts for preparing manure.

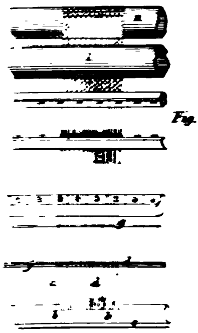


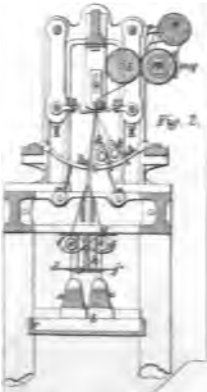
Picault's appts for opening oysters.

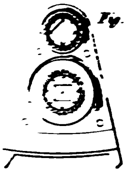




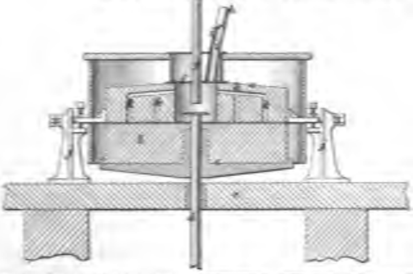
Newton's impd lace machy



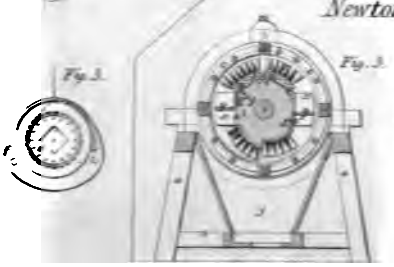


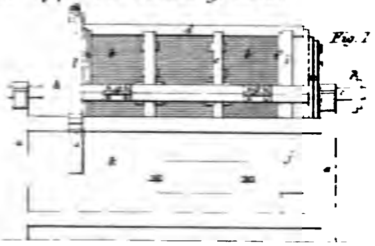


Bovill's impd flour mill

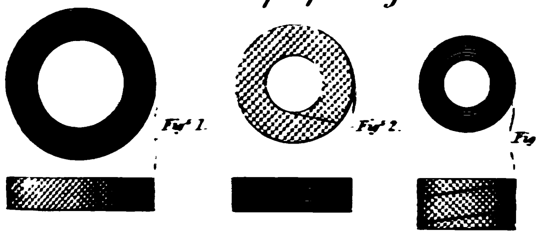


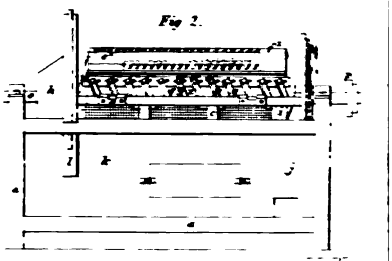
Newton's appts for hulling rice.





Haine's impd packing.





Hick & Gratrix's impts. in steam engines, &c.

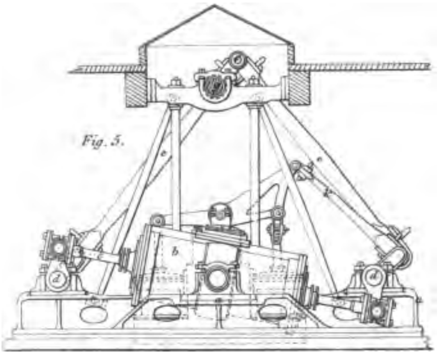


Fig. 5.

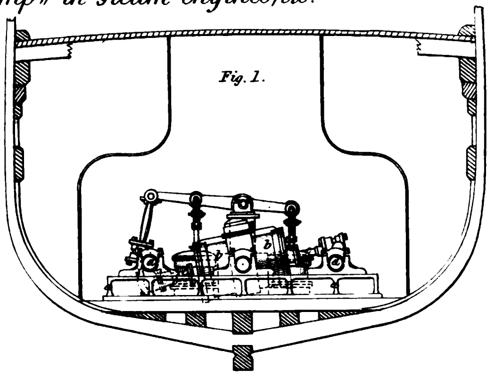
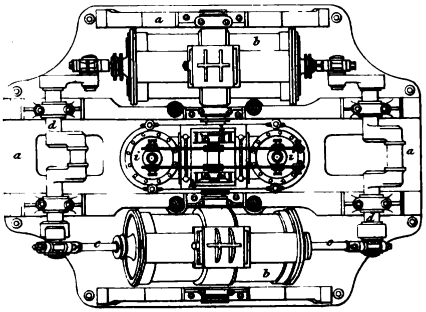


Fig. 1.

Fig. 4.



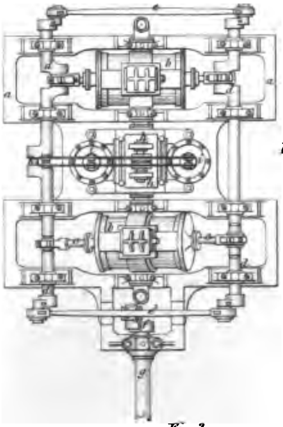
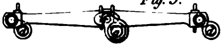


Fig. 2.

Fig. 3.



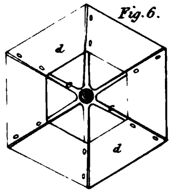


Fig. 6.

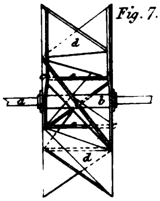
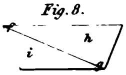


Fig. 7.

Fig. 8.



Preddy's impd. watch-keys.

Fig. 2.

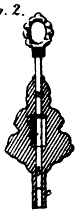
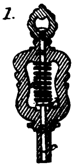


Fig. 1.



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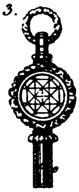


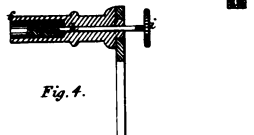


Fig. 4.

Barlow's impts. in railways.

Fig. 1.

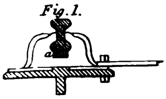


Fig. 2.

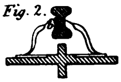


Fig. 4.

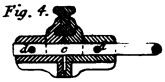


Fig. 5.

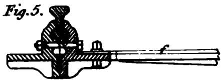


Fig. 6.

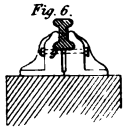
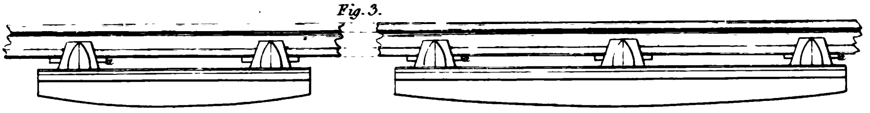


Fig. 3.



Newton del.

1st Jany 1850.

T. Sher